REV	**00**
Date	**02-2025**
Supersedes	

Installation and Operating Manual
D-EIMOC03302-25_00EN

Smart Control System

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Revision	Software Version	Changelog
0 – 02/2025		Introduction of SCS

2 WHAT IS SMART CONTROL SYSTEM

2.1 Smart Control System Description

SmartControlSystem is the next-gen smart central plant room optimization and airside control software system released by Daikin Applied Europe.
SmartControlSystem is a highly specialised control and optimisation solution for plant rooms and airside equipment. created with an in-depth understanding of thermodynamic variables involved in managing HVAC equipment, SmartControlSystem enables optimum control of every device and the integration of the building into a single synergistic system. SmartControlSystem achieves optimisation through a continuous process articulated through various levels of smart software functions.
SmartControlSystem continuously optimises plant working conditions by adjusting equipment staging and sequencing, managing operating set-points throughout the entire HVAC system.
That provides significant energy savings, greater control flexibility and opportunity to optimally operate and maintain any building.
SmartControlSystem has an intuitive HTML5 interface, effortlessly accessible across any web browser. Users gain real-time insights into plant performance, compare equipment efficiency, chart historical data, and monitor alarms. For added flexibility, manual control is readily available through the SmartControlSystem plant manager page.

2.2 Datasheet

Product Name	**SmartControlSystem**
Summary of Features	**Application-wide functionality:** • Feature rich HTML5 user interface • Multi-language support • Alarming • Charting • History **Air-side Equipment Management functionality:** • User-friendly building zone visualization • Single zone AHU/FCU supervisory control • Centralized setpoint control • Remote equipment mode control • Remote equipment start/stop • Manual user override for all controls • Scheduled temperature setpoints setup for building zones • Afterhours cooling/heating • Afterhours Freeze Protection • Pre-cooling/heating mode • Zone temperature setpoint reset using occupancy sensor • Plant cooling/heating call calculation **Water Plant-room Management functionality:** • Advanced staging algorithms • Chilled water temperature optimization • Pumping and distribution optimization • Chiller control & optimization

Applicable system type	• Support up to four Small Inverter Chiller or Heat Pump
	• Support for 2-Pipe Distribution system (Cooling/Heating)
	• Support for Primary Circuit
	  ○ Dedicated Pump Configuration
	  ○ Headered Pump Configuration
	• Support for One Secondary Circuit
	  ○ Headered Pump Configuration
	• Support for Air Cooled side:
	  ○ single-zone AHU
	  ○ single zone FCU
	  ○ single zone Daikin Room Controller + multiple FCU

Equipment compatibility	**Cool/Heat Generation Equipment**: • Daikin EWYT-CZ • Daikin EWAT-CZ **Air Side Equipment**: • Daikin D-AHU Modular T • Daikin D-AHU Modular L • Daikin FWEDA (FCU Controller) • Daikin SHINKA (Room Controller) • Galletti FWECSAP (FCU controller) **Water Circuit Equipment**: • Variable Frequency Driver Danfoss • Variable Frequency Driver HydrovarX

Equipment count/capacity limit	• up to 500kW of combined total Cooling and Heating Capacity
	• Three Sizes:
	  ○ ISCS050: up to 20 FCUs or 10 AHUs
	  ○ ISCS125: up to 70 FCUs or 10 AHUs + 50 FCUs
	  ○ ISCS250: up to 120 FCUs or 10 AHUs + 100 FCUs
	• up to 120 FCUs or 10 AHUs + 100 FCUs

Applicable sectors	• Shopping centre • Small Commercial buildings • University/Educational facilities • Hotels • Casino • Medical facilities • Airport • Plus many more (Contact your local support representative for more information)
Web user interface technology	• Accessible via standard web browser without need for proprietary tools. • Desktop & tablet access. • Secured by HTTPS protocol User access level control. • Read only access for general user, operator access for plant manager user, engineering access for commissioning user.
Hardware platform	**CI-EdgeX series:** • Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.2GHz • 1GB LPDDR2 SDRAM, 8 GB eMMC storage • 2 x 10/100 Mbps ethernet ports • 24VDC +/-10%, Consumption 400mA power supply • 2 x RJ12 Edge Connect breakout, expandable IO • 2 x RS485 ports
Software platform	Niagara N4 framework, developed by Tridium

Table 1 - SmartControlSystem Datasheet

2.3 Small Applied eXpress (Selection Tool)

SmartControlSystem can be selected only through SAX (Small Applied eXpress), small building design and selection tool. SAX guides the user to design the plant (piping dimensioning, flow-rate and differential pressure of the building, etc) and to select the necessary water plant devices (Chiller/Heat Pump, water pumps) and air side equipment (AHU, Fancoil unit, Room controller units) to fulfil the water generation and HVAC needs inside a building.

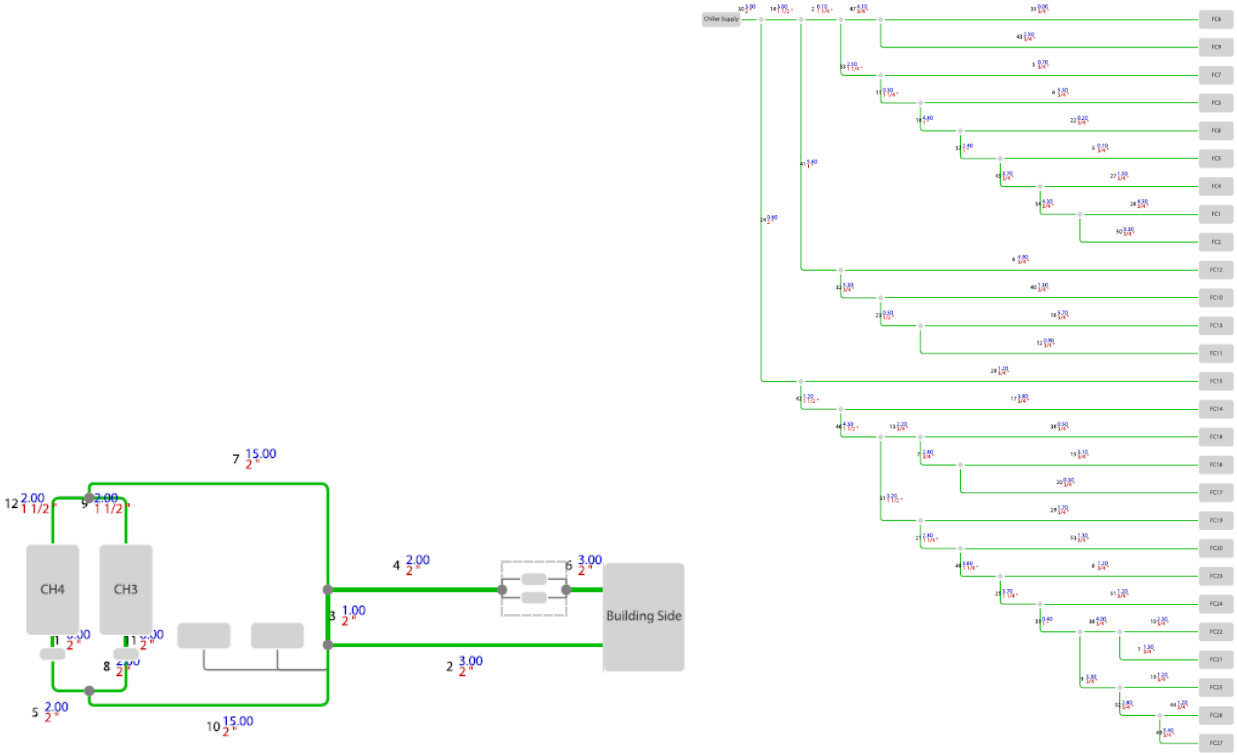


Figure 1 - SAX water plant and air-side design

If the water-plant type and the selected devices are compatible, SAX gives the possibility to add SmartControlSystem and provide the necessary size of SmartControlSystem.

After the selection, SAX generates a configuration file to be imported in SmartControlSystem in order to configure:

1) Water Side management:
    a. Configuration of the water-plant type according to the design (Primary only system or Primary-secondary system)
    b. Configuration of the water-plant control
    c. Configuration of Chiller/Heat Pump, setting the design value of the devices
    d. Configuration of the Water pump, setting the design value of the devices
2) Air Side management:
    a. Configuration of the structure of the HVAC system according to design: Site → Zone Groups → Zones → Equipment
    b. Configuration of the Air handling units, setting the design value of the devices
    c. Configuration of the Fancoil units, setting the design value of the devices.

This configuration file is stored in Daikin Applied server and identified through a unique number that will be communicated by SAX to the user.

Selection in SAX and configuration ID are mandatory to purchase the SmartControlSystem.

2.4 Lisencing

According to the number of devices to be integrated and managed, three different sizes of SmartControlSystem are suggested by SmallAppliedeXpress:

- ISCS050: up to 20 FCUs or 10 AHUs
- ISCS125: up to 70 FCUs or 10 AHUs + 50 FCUs
- ISCS250: up to 120 FCUs or 10 AHUs + 100 FCUs

The license is strictly related to the size of the SmartControlSystem and it is unique for the controller inside SmartControlSystem.

In case of changes in configuration that can increase the number of devices integrated and possible request of a different license, SmartControlSystem stop working.

3 INSTALLATION

3.1 Compatible Water Plant type

SmartControlSystem can manage a certain number of plant-layout and specific devices in the water plant as listed in paragraph 2.2 Datasheet.
SmartControlSystem can manage only two-pipe systems, i.e Cooling-only or Heating only or Reversible (Cooling/Heating)
The possible plant-layout are as follows:

1) Primary Variable-only
2) Primary Constant – Secondary Variable.

For the primary loop, there could be two possible configurations of water pumps:

1) Dedicated pumps: each Daikin Unit has and manages its own onboard pump (one pump per units)
2) Manifolded pumps: SmartControlSystem can manage up to five pumps in parallel that serve up to four Daikin Units. SmartControlSystem controls those pumps through a compatible variable frequency driver (VFD).

> ***SmartControlSystem manages specific VFDs (selected through SAX). The VFD must be installed in both types of pumps, i.e. controlled in variable flow and constant flow.***

For the secondary loop, SmartControlSystem can manage up to one secondary circuit composed by up to two manifolded pumps through a compatible VFD.

3.1.1 Primary Variable Only

A Primary Variable-Only system is composed by only one circuit where Daikin units and Air side equipment are connected to. The circuit flow is regulated by the primary pumps.
SmartControlSystem can manage two type of pump configuration for a Primary Variable-only system:

3.1.1.1 Dedicated pumps

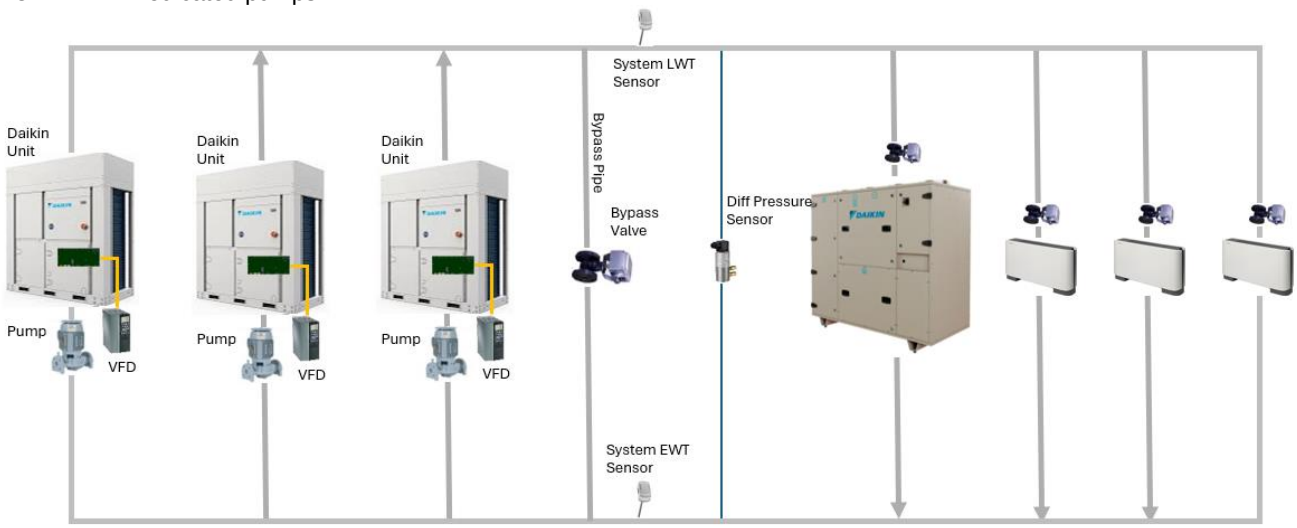


Figure 2 - Dedicated Primary Variable Only

Legend	Description
Daikin Unit	Daikin Chiller or Heat-pump unit
Pump with VFD	Pump with Variable frequency driver
Bypass pipe	Pipe or Decoupler that connects Return Header to Supply Header
Bypass Valve	Valve installed on bypass that avoid the high differential pressure on field side
System LWT Sensor	Sensor to measure the Leaving (Supply) water from primary circuit
System EWT Sensor	Sensor to measure the Entering (Return) water from primary circuit
Diff Pressure Sensor	Sensor to measure the Differential pressure on field side
Valve	Valve commanded by airside equipment

- VFD of Onboard pumps is connected and managed by Daikin unit through communication, while SmartControlSystem regulates the speed of the VFD communicating with the unit.
- Bypass pipe with a motorized bypass valve must be installed and controlled by SmartControlSystem.
- Differential pressure sensor must be installed downstream of the bypass pipe and connected to SmartControlSystem, allowing the control of the VFD pumps and Bypass Valve actuator.
- Leaving water temperature is connected to first Daikin Unit and its value is communicated to SmartControlSystem.
- Entering water temperature is an optional that can be requested during selection of the system.

3.1.1.2 Manifolded pumps

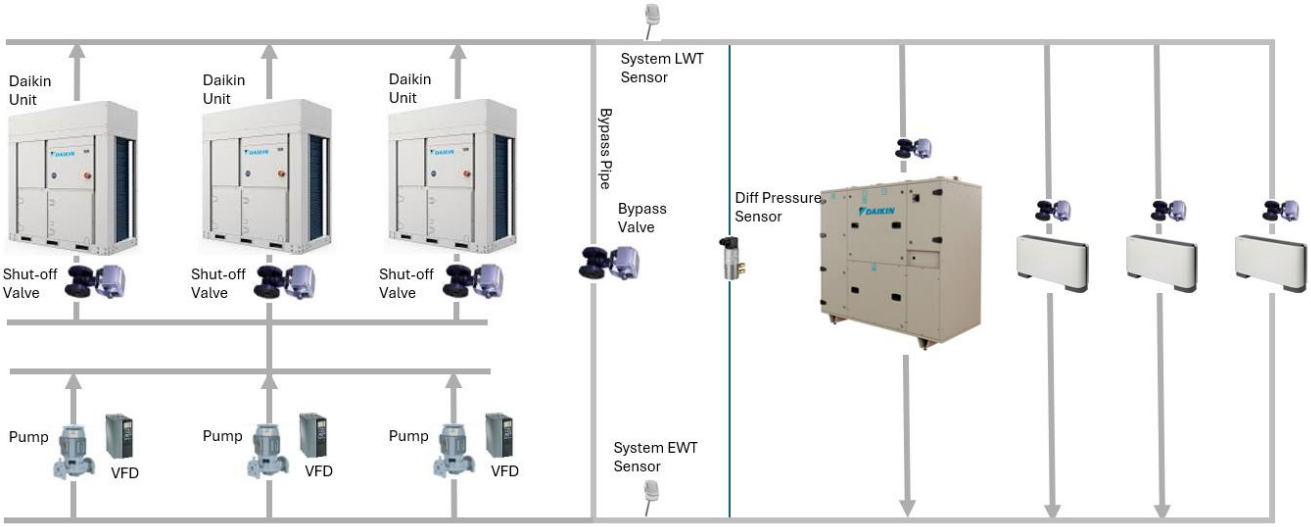


Figure 3 - Manifolded Primary Variable Only

Legend	Description
Daikin Unit	Daikin Chiller or Heat-pump unit
Shut-off valve	Valve to stop the water flow through unit exchanger
Pump with VFD	Pump with Variable frequency driver
Bypass pipe	Pipe or Decoupler that connects Return Header to Supply Header
Bypass Valve	Valve installed on bypass that avoid the high differential pressure on field side
System LWT Sensor	Sensor to measure the Leaving (Supply) water from primary circuit
System EWT Sensor	Sensor to measure the Entering (Return) water from primary circuit
Diff Pressure Sensor	Sensor to measure the Differential pressure on field side
Valve	Valve commanded by airside equipment

- External pumps with compatible VFD are provided by Daikin (Daikin Units are not provided with onboard pump). Variable Frequency Drivers must be connected to SmartControlSystem. SmartControlSystem manages the command, feedback, speed of the pump through the communication with VFD.
- A Shut-off valve must be installed and connected to dedicated to each unit. Daikin Unit commands the shut-off valve actuator.
- Bypass pipe with a motorized bypass valve must be installed and controlled by SmartControlSystem.
- Differential pressure sensor must be installed downstream of the bypass pipe and connected to SmartControlSystem, allowing the control of the VFD pumps and Bypass Valve actuator.
- Leaving water temperature is connected to first Daikin Unit and its value is communicated to SmartControlSystem.
- Entering water temperature is an optional that can be requested during selection of the system.

3.1.2 Primary Constant – Secondary Variable

A primary constant – secondary variable system is composed by two circuit. The first circuit is the piping loop where Units and Primary Pumps are connected to; whereas the second circuit is the piping loop where secondary pumps and air side equipment are connected to. The two loops are linked to each other through a bypass pipe; the bypass pipe is mandatory to decouple the flow of the primary pumps from secondary ones.
SmartControlSystem can manage two configurations of primary pumps, it can also manage the secondary pumps.

3.1.2.1 Dedicated Primary Constant – Secondary Variable

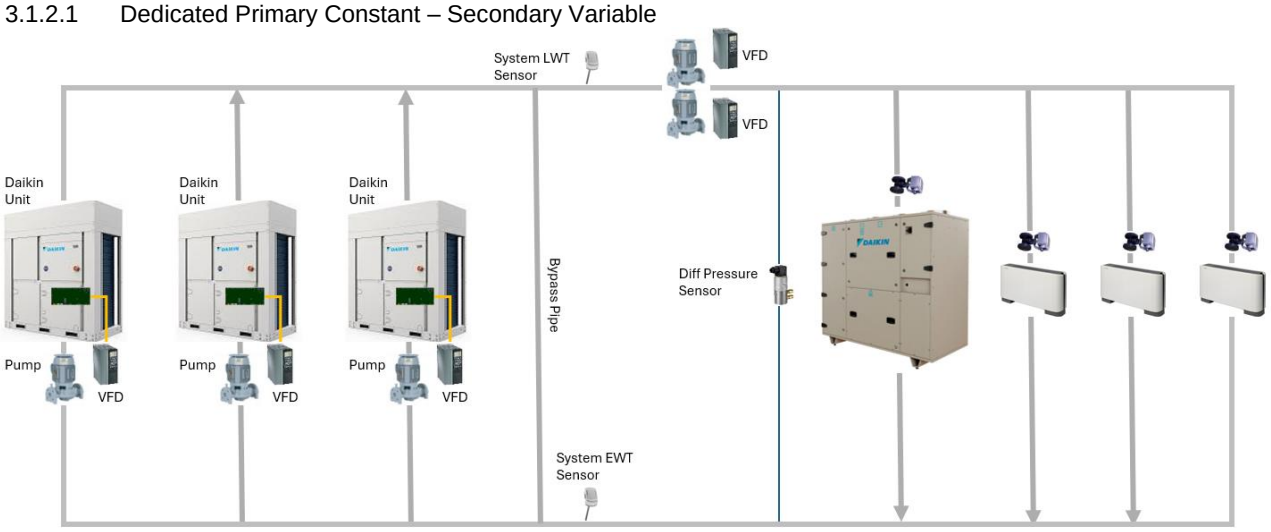


Figure 4 - Dedicated Primary Constant - Secondary Variable

Legend	Description
Daikin Unit	Daikin Chiller or Heat-pump unit
Pump with VFD	Pump with Variable frequency driver
Bypass pipe	Pipe or Decoupler that connects Return Header to Supply Header
Bypass Valve	Valve installed on bypass that avoid the high differential pressure on field side
System LWT Sensor	Sensor to measure the Leaving (Supply) water from primary circuit
System EWT Sensor	Sensor to measure the Entering (Return) water from primary circuit
Diff Pressure Sensor	Sensor to measure the Differential pressure on field side
Valve	Valve commanded by airside equipment

- VFD of Onboard pumps is connected and managed by Daikin unit through communication; speed of the VFD is fixed and communicated by Daikin Units to provide constant flow.
- Bypass pipe must be installed to decouple the primary circuit from secondary circuit.
- Leaving water temperature is connected to first Daikin Unit and its value is communicated to SmartControlSystem.
- Entering water temperature is an optional that can be requested during selection of the system.
- External pumps with compatible VFD are provided by Factory serving as Secondary pump. Variable Frequency Drivers must be connected to SmartControlSystem. SmartControlSystem manages the command, feedback, speed of the pump through the communication with VFD.
- Differential pressure sensor must be installed downstream of the bypass pipe and secondary pumps and connected to SmartControlSystem, allowing the control of the VFDs of secondary loop.

3.1.2.2 Manifolded Primary Constant – Secondary Variable

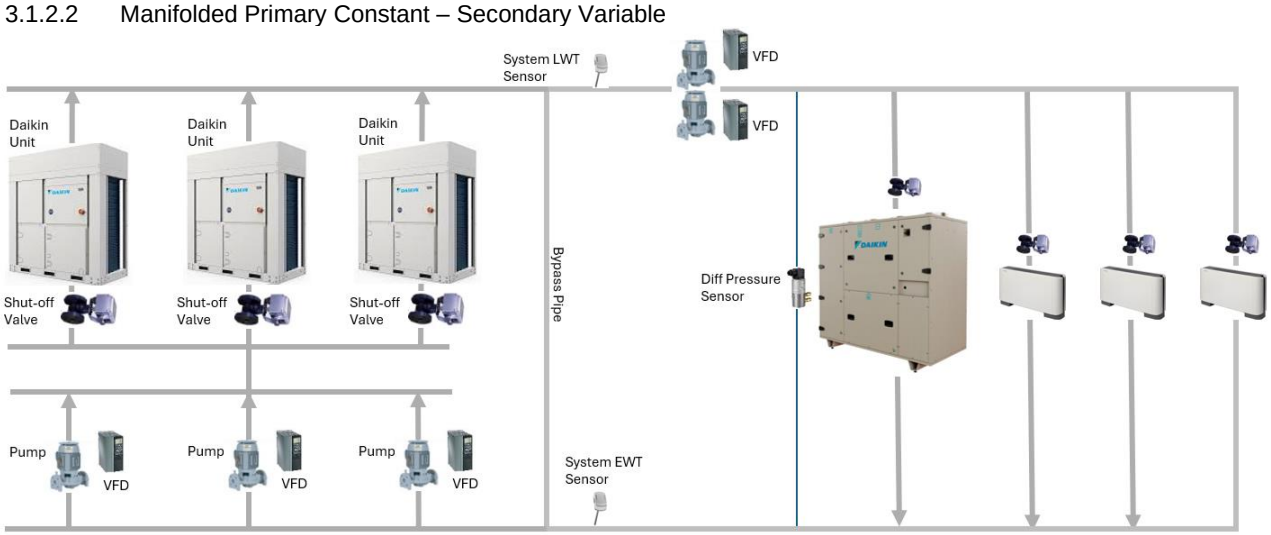


Figure 5 - Manifolded Primary Constant - Secondary Variable

Legend	Description
Daikin Unit	Daikin Chiller or Heat-pump unit
Shut-off valve	Valve to stop the water flow through unit exchanger
Pump with VFD	Pump with Variable frequency driver

Bypass pipe	Pipe or Decoupler that connects Return Header to Supply Header
Bypass Valve	Valve installed on bypass that avoid the high differential pressure on field side
System LWT Sensor	Sensor to measure the Leaving (Supply) water from primary circuit
System EWT Sensor	Sensor to measure the Entering (Return) water from primary circuit
Diff Pressure Sensor	Sensor to measure the Differential pressure on field side
Valve	Valve commanded by airside equipment

- External pumps with compatible VFD are provided by Factory (Daikin Units are not provided with onboard pump), serving as primary pumps. Variable Frequency Drivers must be connected to SmartControlSystem. SmartControlSystem manages only the command and feedback, whereas speed of the pump must be configured as fixed on VFD.
- A Shut-off valve must be installed and connected to dedicated to each unit. Daikin Unit commands the shut-off valve actuator.
- Bypass pipe must be installed to decouple the primary circuit from secondary circuit.
- Leaving water temperature is connected to first Daikin Unit and its value is communicated to SmartControlSystem.
- Entering water temperature is an optional that can be requested during selection of the system.
- External pumps with compatible VFD are provided by Factory serving as Secondary pump. Variable Frequency Drivers must be connected to SmartControlSystem. SmartControlSystem manages the command, feedback, speed of the pump through the communication with VFD.
- Differential pressure sensor must be installed downstream of the bypass pipe and secondary pumps and connected to SmartControlSystem, allowing the control of the VFDs of secondary loop.

3.2 Hardwired Connections

3.2.1 Leaving water temperature sensor

For the management of primary circuit and Chiller/Heat Pump by SmartControlSystem, a Leaving Water Temperature sensor is mandatory.
The sensor must be installed in the plant-room downstream of the bypass pipe (towards field / secondary side)
Type of sensor to use is:

- Daikin NTC10K (with a beta of 3977), that can be bought as an “accessory” of the Daikin unit in the material request.

This sensor must be connected to the System Temperature input of the Daikin Unit that is configured with Modbus Address = 1.

Please refer to Daikin Unit Electrical Diagram for detailed information.

3.2.2 Entering water temperature sensor

“Optional” Entering Water Temperature can be selected in SAX and connected to SmartControlSystem. In case the sensor will not be used, SmartControlSystem will calculate the average of entering water temperature of the running units.
The sensor must be installed downstream of the bypass pipe (towards field / secondary side)
Type of sensor to use is:

- Daikin NTC10K (with a beta of 3977), that can be bought as an accessory of the Daikin unit in the material request.

The sensor must be connected to Input/Output module inside SmartControlSystem panel
Please refer to SmartControlSystem Electrical Diagram for detailed information.

3.2.3 Differential pressure sensor

In Primary Variable-only system, a differential pressure sensor is mandatory to control the speed of the pump and the opening of the bypass valve. The sensor must be mounted downstream of the bypass pipe (towards field/Secondary side).
In Primary Constant - Variable Secondary system, a differential pressure sensor is mandatory to control the speed of the pump. The sensor must be mounted downstream of the bypass and secondary pump towards field/airside equipment.
The sensor is included by SmallAppliedExpress in the Factory provision.
The sensor type is:

- Field Differential Pressure transducer: signal 0…10Vdc, power supply at 24VDC.

The sensor must be connected to Input/Output module inside SmartControlSystem panel. The sensor is powered supply by panel. The cable connection must be done using:

- 3x 1,5 mm2 wire

Please refer to SmartControlSystem Electrical Diagram for detailed information.

3.2.4 Bypass Valve actuator

In Primary Variable primary- only system a valve must be installed on the bypass pipe connecting the supply and return header. The bypass pipe, linking supply header with return header, must be mounted between Daikin units and air side equipment.
The type of actuator to use is:

- `By-pass Valve Modulation`: 0…10Vdc Output Signal to open of the valve actuator.

> ***Actuator must have supply at 24VDC and the supply is provided by SmartControlSystem Panel***

The actuator must be connected to Input/Output module inside SmartControlSystem panel.
The cable connection using:

- 3x 1,5 mm2 wire

Please refer to SmartControlSystem Electrical Diagram for detailed information.

3.2.5 Dedicated Shut-off Valve

In plant-room where primary water distribution is designed as manifolded piping, primary pumps are installed in parallel and provide water flow to all the units. In order to avoid water flow when the unit is shut-down, shut-off valve must be installed on the outlet pipe of each unit.
Each unit can manage the closure or opening of the shut-off valve through the following output:

- `Pump #1 Request: Digital Output` (Normally Open contact) to be used as Close/Open Command .

The following scheme shows the electrical device that must be installed in unit panel and connections with valve actuator:

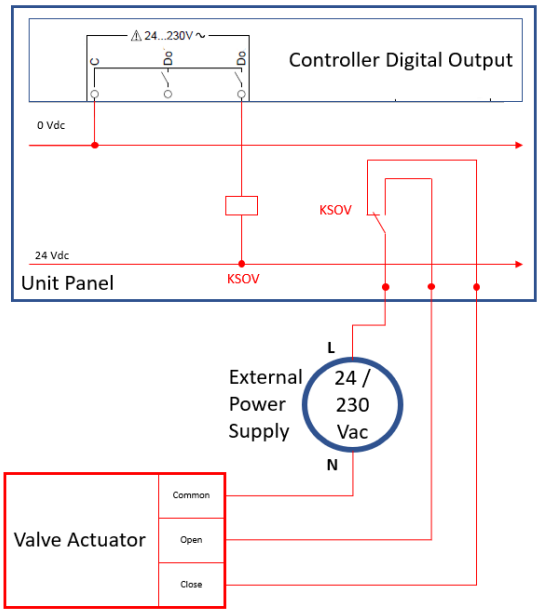


Figure 6 - Shut-off valve electrical installation

Legend	Description
`Controller Digital Output`	Digital output of Daikin Unit Controller
`Unit panel`	Electrical panel of the Daikin Unit
`KSOV`	Relay to command Valve Actuator
`External Power Supply`	Power Supply device at 24 or 230 Vac for Valve actuator comamnd
`Valve Actuator`	Actuator of the Shut-off valve
`Common`	Common terminal of valve actuator
`Open`	Open Command terminal of valve actuator
`Close`	Close Command terminal of valve actuator

The digital ouput of the Daikin unit controller must be connected to an External Relay that can provide separated Normally Close and Normally Open contact to send open/close command to valve actuator.

> ***Installation of KSOV Relay, External Power supply, Valve actuator and body are not part of Factory provision***

3.3 SmartControlSystem Network connection

SmartControlSystem manages the compatible Daikin devices through Modbus/RTU Communication Network inside the building.
SmartControlSystem provides six Modbus RS485 ports, each dedicated to a group of devices in the building.

A) Port RS485_1: is dedicated to Daikin devices installed in the plant room such as:
   - Daikin Small Inverter Chiller
   - VFDs of Primary Pump (HydrovarX or Danfoss)
   - VFDs of Secondary Pump (HydrovarX or Danfoss)

B) Port RS485_2: is dedicated to `Daikin AHU, Daikin Room Controller, Fancoil PCB`

C) Port RS485_3, _4, _5, _6: is dedicated to `Daikin Room Controller, Fancoil PCB`

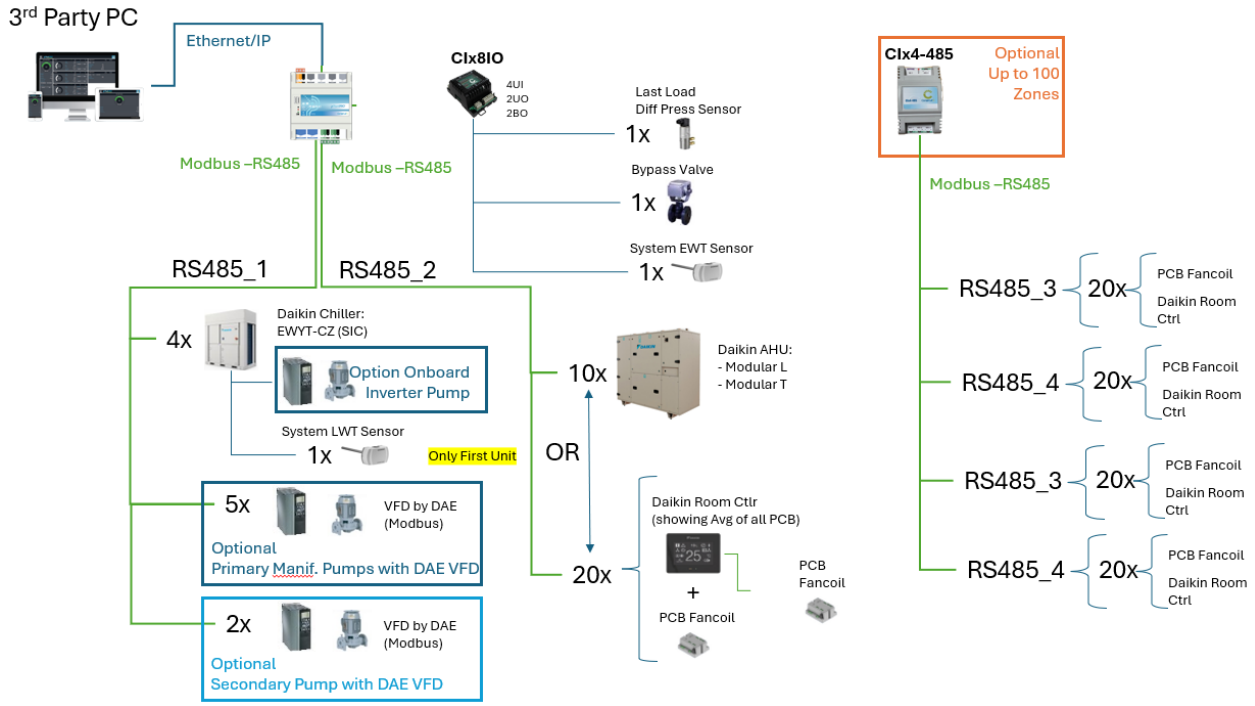


Figure 7 - Cable and Network Architecture

Legend	Description
3rd Party PC	Personal Computer/ Tablet not provided by Daikin
CI-EdgeX	SCS main controller
CIx8IO	SCS expansion module for Input/Output signal
CIx4-485	SCS expansion module for Modbus communication
Daikin Unit	Daikin Chiller or Heat-pump unit
Option Onboard Inverter pump	Daikin Unit Optional: Onboard Pump with VFD
Optional Primary Manif. Pump with DAE VFD	SCS Optional: Pump with VFD provided by Daikin for Primary manifolded circuit
Optional Secondary Pump with DAE VFD	SCS Optional: Pump with VFD provided by Daikin for Secondary circuit
System LWT Sensor	Sensor to measure the Leaving (Supply) water from primary circuit (to be installed only on first unit)
System EWT Sensor	Sensor to measure the Entering (Return) water from primary circuit
Last Load Diff Press Sensor	Sensor to measure the Differential pressure on field side
Bypass Valve	Valve installed on bypass that avoid the high differential pressure on field side
Daikin AHU	Daikin Air Handling Unit
Daikin Room Ctlr	Daikin Room controller, able to show the average of variable of the connected Fancoil PCB
Fancoil PCB	Controller of Fancoil

3.3.1 SCS Modbus Network installation

It is important to respect the below limitation to avoid instability in the communication network:
- 3-wire cable Twisted and Shielded
- Electrical characteristics:

- Nom. Conductor DCR: 72 Ohm/km
- Nom. Capacity: 39pF/m
- Nom. Impedance: 120 Ohm

- Bus cable length between 2 Units Max. 700 m
- Total bus cable length Max. 1,000 m

If more than 10 devices are connected to a Modbus network, two resistors 120 Ohm must be connected to the beginning (SmartControlSystem panel RS485 terminals) and to the end of the cabling (last device RS485 terminals).

Starting from SCS panel, the RS485 terminals [Ref1, A+, B-] of each devices must be connected in parallel.

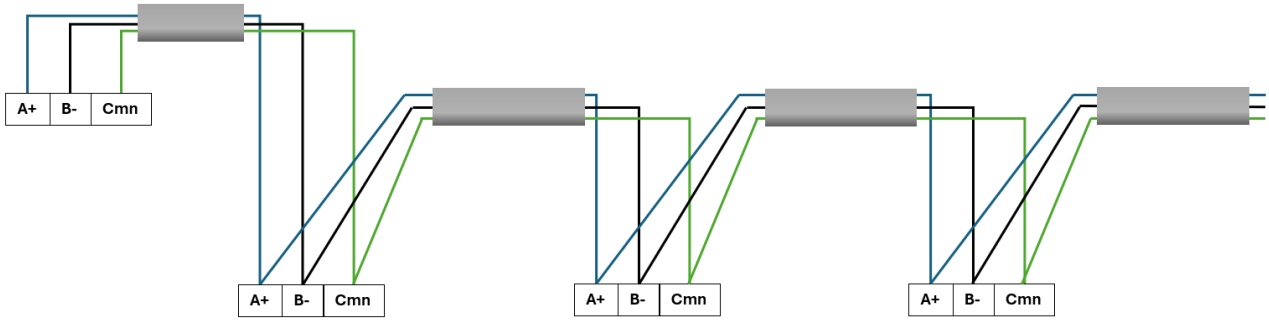


Figure 8 - General Example of Modbus Network

Do not connect additional devices to Modbus network except of SCS compatible devices

Star or tree configuration of the Modbus network are not supported and they can cause communication issues.

Waterside equipement must be connected on the port RS485_1

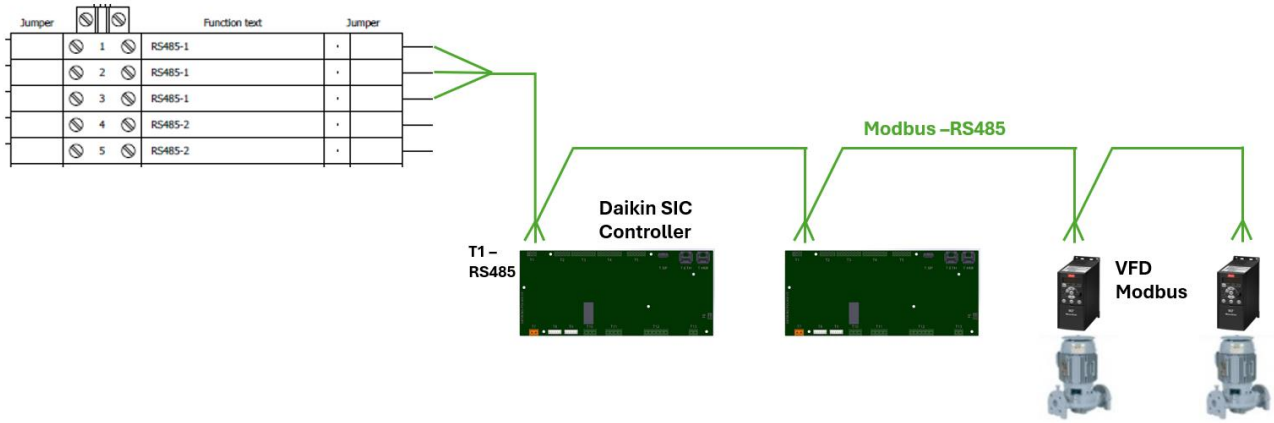


Figure 9 - Water side equipment network

Airside equipment can be connected to RS485 ports from 2 to 6

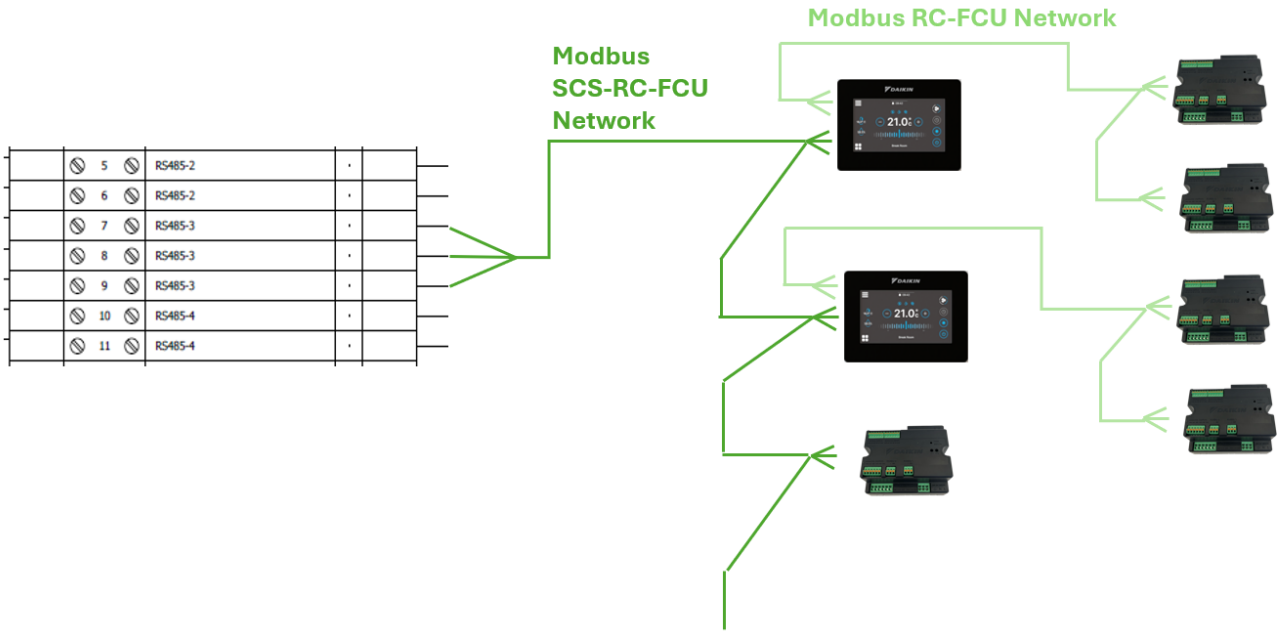


Figure 10 - Air side equipment network

> ***Modbus Network between Daikin Room controller and the managed FCU PCB (Modbus RC-FCU Network) must not be connected to Modbus Network between SmartControlSystem and Room Controllers (Modbus SCS-RC-FCU Network)***

3.3.2 SCS Modbus Network Addressing

SmallAppliedeXpress at each selection provides a "Commissioning Guide" that shows the Modbus Address to be set on all the devices (address) and the Modbus port of SmartControlSystem panel which the device must connect to.
The list will be like the following:

Daikin Devices	Address	SCS Port
EWYT,	From 1 to 240	RS485_1 to RS485_6
HydrovarX/Danfoss inverters	From 1 to 240	RS485_1 to RS485_6
AHU	From 1 to 240	RS485_2 to RS485_6
RC	From 1 to 240	RS485_2 to RS485_6
FCU	From 1 to 240	RS485_2 to RS485_6

Table 2 - Commissioning Guide - Modbus Addressing

All the equipment connected to the SCS port RS485_1 (waterside equipment) must have the following Modbus Communication parameter:

- Baudrate: 19200
- Parity: None
- StopBits: 2

All the equipment connected to the SCS port RS485_2 to 6 (airside equipment) must have the following Modbus Communication parameter:

- Baudrate: 19200
- Parity: None
- StopBits: 1

3.3.3 How to connect and configure EWYT-CZ/EWAT-CZ

Daikin unit must be connected to the SCS modbus network according to the following picture:

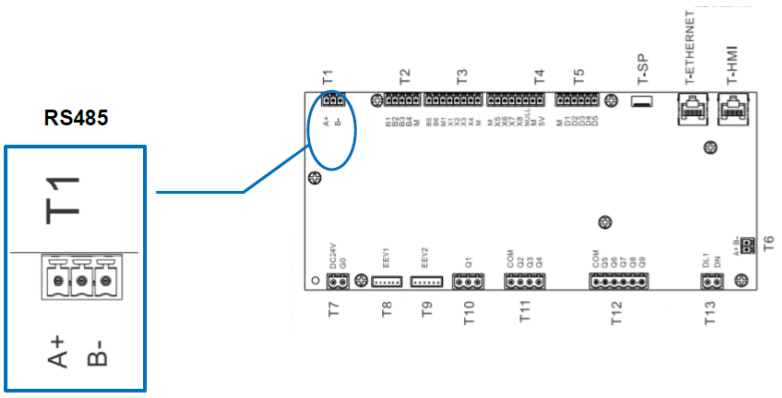


Figure 11 - Daikin Unit Modbus port

Daikin unit has the Modbus RTU communication enabled by default.
The Modbus RTU communication parameters (Address, BaudRate, Parity, StopsBits) must be set in the following menu

- WEB HMI: `MainMenu → View/Set Unit → Protocols`
- HMI: `Page [22]`

Secondly, Daikin Units must be configured to be commanded by SmartControlSystem. User needs to set the following parameter:

- WEB HMI: `MainMenu→ View/Set Unit → Unit → Network Control = DAEbms`
- HMI : `Page [4] – Param [00] = 2`

After that, controller must be saved and rebooted.

⚠	***Please refer to IOM and Control Manual of the equipment: D-EOMHP014##-##***

3.3.4 How to connect and configure Daikin SHINKA

SmartControlSystem can be connected to a modbus network composed by:

- only Shinka (with their own network of Fancoil PCB)
- only Fancoil Control Board (not connected to Shinka)
- Mixed of Shinka and Fancoil Control Board.

Shinka o Control Board must be configured with the modbus parameters (Address and Baudrate) listed in the paragraph **3.3.2 SCS Modbus Network Addressing.**

⚠	***Please refer to IOM and Control Manual of the equipment: SHINKA Control***

Management by SmartControlSystem is already active and no more actions are required.

3.3.5 How to connect and configure FWTOUCH

SmartControlSystem can be connected to a modbus network composed by Fancoil Control Board FWTOUCH.
Only the following configurations are compatible with SmartControlSystem Network:

- Connection among Fancoil PCBs (with no slave OC) and SCS using the RS485 port and configuration as SPV Slave
- Connection among the MasterOC PCBs and SCS using the RS485 port and configuration as SPV Slave.

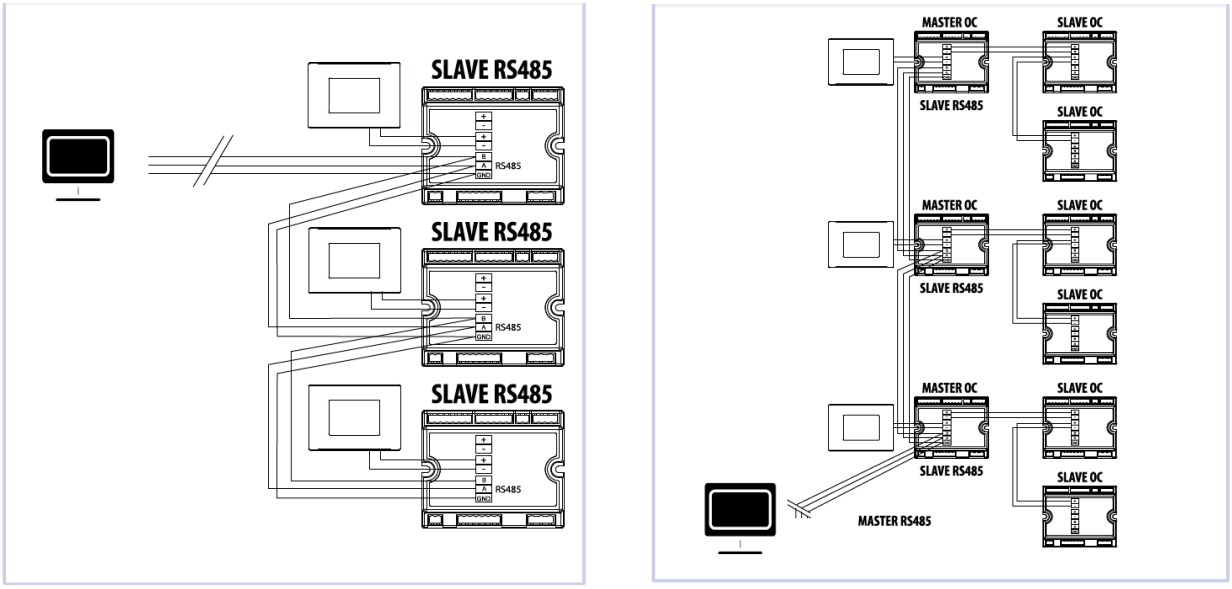


Figure 12 - FWTOUCH - Modbus Network configuration

FWTouch must be configured with the modbus parameters (`Address` and `Baudrate`) listed in the paragraph **3.3.2 SCS Modbus Network Addressing.**

> ***Please refer to IOM and Control Manual of the equipment: FWTOUCH***

3.3.6 How to connect and configure Pump Driver EXM for Hydrovar X

In case of Manifolded primary pumps or Secondary pumps, DAE provides the pump with an on board `Variable Speed Driver: HydrovarX – EXM driver`. The Driver port RS485_2 must be connected to SmartControlSystem Modbus network for water side equipment.

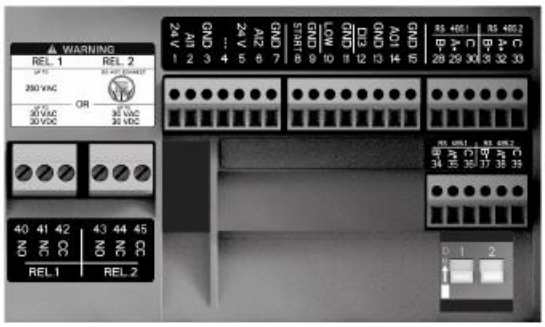


Figure 13 - HydrovarX EXM terminal board

Driver must be configured through HydrovarX EXM display to set the Modbus Communication parameters and functional parameters:

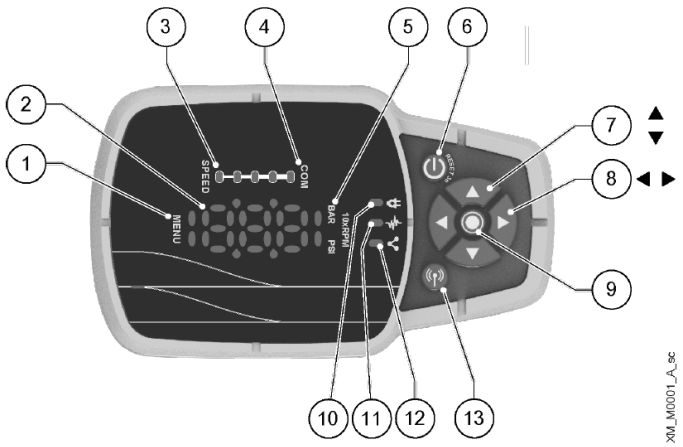


Figure 14 - HydrovarX display

Position Number	Name	Function
1	Menu indicator	Indicate: Navigation through the menu items (steady light) The display of a parameter value (flashing light).
2	Seven-segment display	
3	Speed bar	
4	Multi-pump communication indicator	
5	Unit of measure indicator	
6	ON/OFF button	Start and stop the unit Reset the errors by pressing for 5 seconds.
7	UP and DOWN arrow keys	Quickly change the setpoint in the main display Navigate through the submenus and change the parameter displayed in the parameter menu Perform a manual switch-over on a multi-pump system by pressing the DOWN arrow (extended pressure) Rotate the display 180° by simultaneously pressing ENTER and the UP arrow (extended pressure).
8	RIGHT and LEFT arrow keys	Show speed and pressure in alternation in the main display Navigate the parameter menu levels LEFT arrow only, confirm the changed value Lock and unlock the display by simultaneously pressing the RIGHT and LEFT arrows (extended pressure). RIGHT arrow only, navigate through the active error codes, if more than one are present
9	SEND button	Advancing through the menu levels Confirm the value of a parameter Enter the parameter configuration menu (extended pressure).
10	Unit LED on	Indicate that the unit is powered.
11	Unit status LED	Indicate: Motor not powered (off) Alarm active and motor stopped (yellow) Unit error and motor stopped (red) Motor started (green) Alarm active and motor started (yellow alternating green).
12	Connection status LED	Indicate: BMS communication disabled (off) BMS communication active (green) Wireless communication with mobile device established (fixed blue) Wireless communication with mobile device being established (flashing blue) Wireless communication and BMS communication active (blue alternating green).
13	Wireless technology communication button	Connect the unit to a mobile device.

The parameters to be changed are listed below:

Parameter	Name	Description	Default	For SCS
P01.0.06	Control Mode	Select the control mode for the pump. 0. Actuator (ACT): The unit operates as a constant speed actuator. It can only be used for one unit in single operation. 1. Constant Pressure (CP): The unit maintains constant pressure regardless of flow variation. 2. Prop. Press. (PP): The unit increases the pressure setpoint linearly proportional to the flow. 3. Prop. Quad. Press.: The unit increases the pressure setpoint (actual demand value) quadratically proportional to the flow. 4. Constant Flow: The unit varies the motor speed to keep the flow constant. 5. Constant Temp: The unit varies the motor speed to keep the temperature constant.	Default = Constant Pressure	Actuator

		6. Constant Level: The unit varies the motor speed to keep the level constant (for example in a tank or well). 7. Generic: The unit varies its speed to maintain a constant generic measured quantity.		
Setpoint				
P04.1.60	Limit setpoint saving	The function limits the number of saves in internal memory. To be enabled in case of continuous writing of the setpoint by the fieldbus.	Default = No	Yes
Modbus RTU Communication parameters				
P08.1.01	Modbus RTU Address	Select the unit address in the Modbus RTU network.	Min = 0 Max = 127 Default = 1	Addres in Commissioning Guide
P08.1.02	Modbus RTU Baudrate	Select the unit network baudrate in order to match the baudrate of the Modbus RTU master.	Default = 115200	19200
P08.1.08	Modbus RTU Format	Select the unit network format in order to match the format of the Modbus RTU master.	Default = 8N1	8N2

Please refer to installation operating and programming manual of the equipment: Xylem hydrovarX Series - Motor with integrated variable speed drive EXM

3.4 SmartControlSystem Interface

It is possible to access the SmartControlSystem interface connecting the Ethernet Port to any computer using any web browser.
If a web browser on a third party support device is not available, SmartControlSystem cannot be accessed.
The cable to be used is:

- Type: Ethernet CAT6A LSZH.

A computer or touch panel is not part of Daikin provision.

4 NAVIGATION

SmartControlSystem is provided with a web interface. This interface can be accessed through any web Browser (MS Edge. Google Chrome, Firefox, etc).
User needs to connect a Personal computer or tablet through an ethernet cable to the SmartControlSystem controller Ethernet port.
SCS Controller has two Ethernet ports configured with default IP address

- Ethernet Port 1 (Eth0):
  - `IP Address: 192.168.1.100`
- Ethernet Port 2 (Eth1):
  - `IP Address: 192.168.40.200`
- Both Port:
  - `SubnetMask: 255.255.255.0`

Typing in the web browser the address https:\\192.168.1.100:9092, the login page will display

SmartControlSystem controller and panel are not provided with a physical interface. User must provide a personal computer or a tablet to access to the controller.

4.1 Login Page

Upon reaching login screen of SmartControlSystem web interface, the user will first be prompted to enter a username and password.
There are three level of access, each of them with specific rights:

- `Dashboard`: able to access and monitor the plant operation only to the `Overview` page. Dashboard user has no access to the configuration portal and `Plant manager` view.
- `PlantManager`: PlantManager user operate manually the device of the plant. PlantManager can monitor the whole system and override commands and setpoints for Water Side and Air Side devices.
- `Configurator`: Configurator user can commission a SmartControlSystem project installation and edit plant design information and control parameters. Config user can change configuration of SmartControlSystem, to change settings of the control functions, to override commands and setpoints for each device, monitor the whole system.

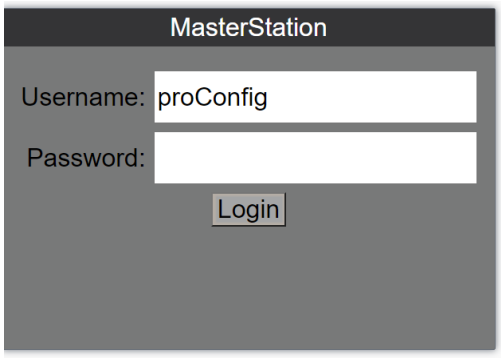


Figure 15 - Login Screen

4.2 Navigation Menu

According to access level a different menus can be accessed.
In case of Dashboard level, only `Overview` page will display. User can monitor the main information and access to `Alarm` page.

Figure 16 - Overview page

In case of `PlantManager` level, user has access to Plant manager menus where plant can be operated manually.

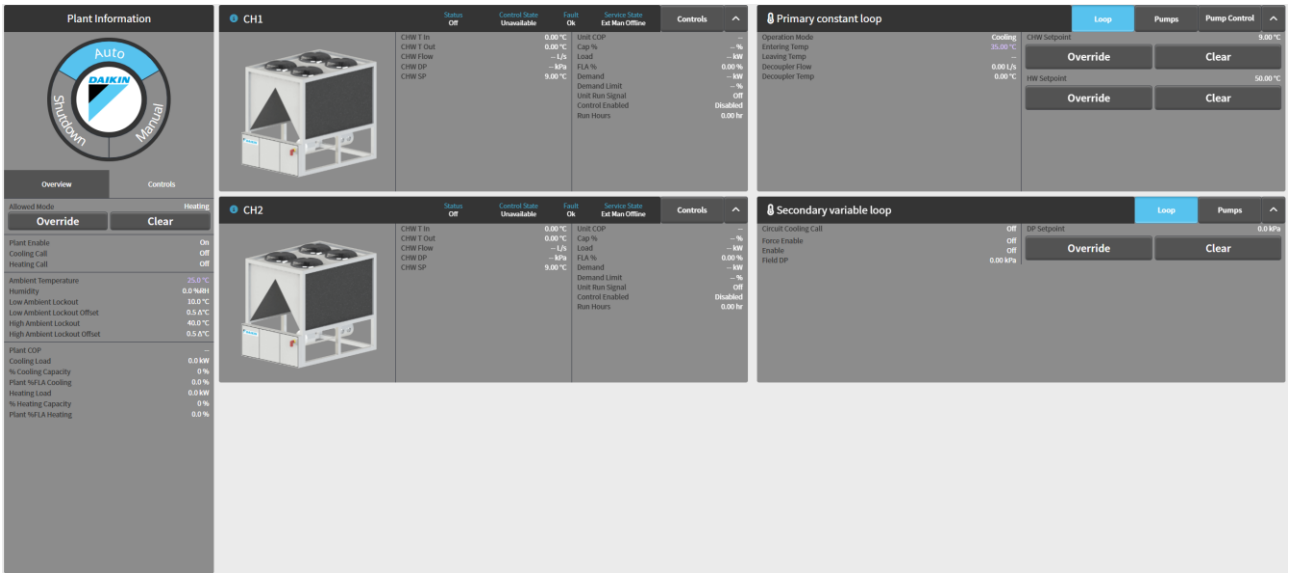


Figure 17 - PlantManager page

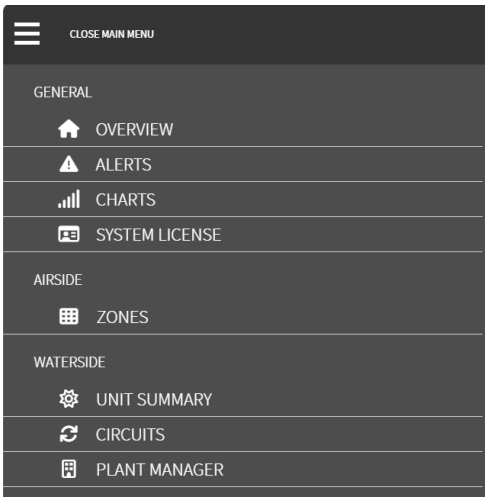


Figure 18 - PlantManager Menus

In case of Configurator level, user has access to `Overview Page`, Plant Manager menus, Configuration menus:

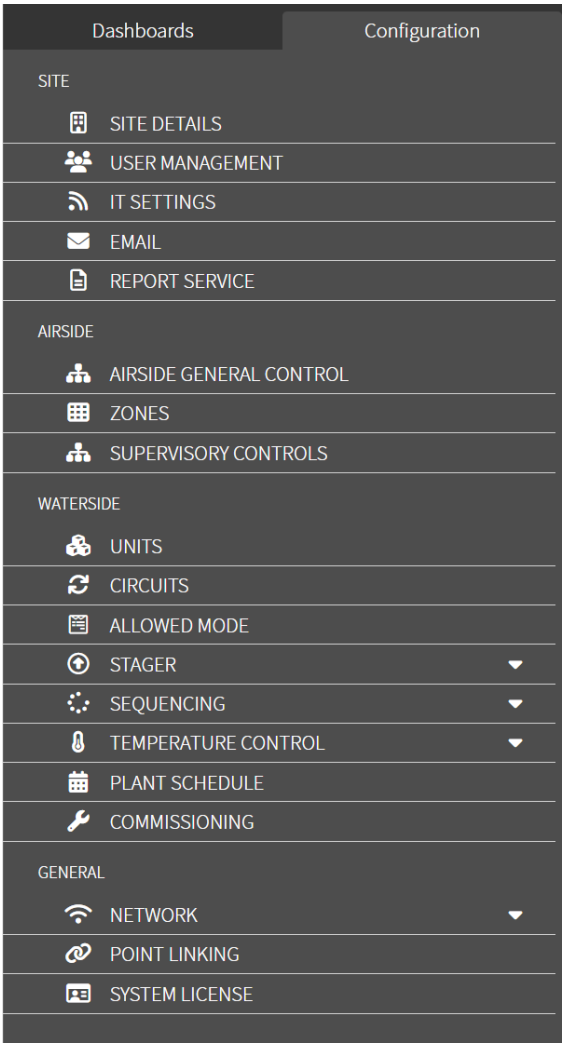


Figure 19 - Configuration Menus

5 Settings Manual

SmartControlSystem settings of the functions to manage the HVAC system can be changed accessing with Configuration access level.
The navigation menu will appear from the left side of the screen as below. Only the highlighted menu are Settings menus.
Those menus contain parameter to be fine-tuned during the commissioning of the system.

- SITE
  - Site Configuration
  - **User Management**
  - **IT Settings**
  - **Email**
  - **Report Service**
- AIRSIDE
  - **Airside General Control**
  - Zones
  - **Supervisor Control**
- WATERSIDE
  - Units
  - Circuits
  - **Allowed Mode**
  - **Stager**
  - **Sequencing**
  - **Temperature Control**
  - **Plant Schedule**
  - **Commissioning**
- GENERAL
  - Network
    - BACnet
  - Point Linking
  - System License

Not highlighted menu are Configuration menu that are automatically filled importing Configuration File generated by SmallAppliedeXpress.
It is highly recommended to NOT change any parameter in the Configuration menus.

5.1 Airside General Control Settings

In the Airside General Control page the user will be able to set the general airside control settings and enable the following optional control modes:

- Pre-Cooling and/or Pre-Heating Modes
- Afterhours Cooling and/or Heating
- Freeze Protection Mode
- Unoccupied Mode

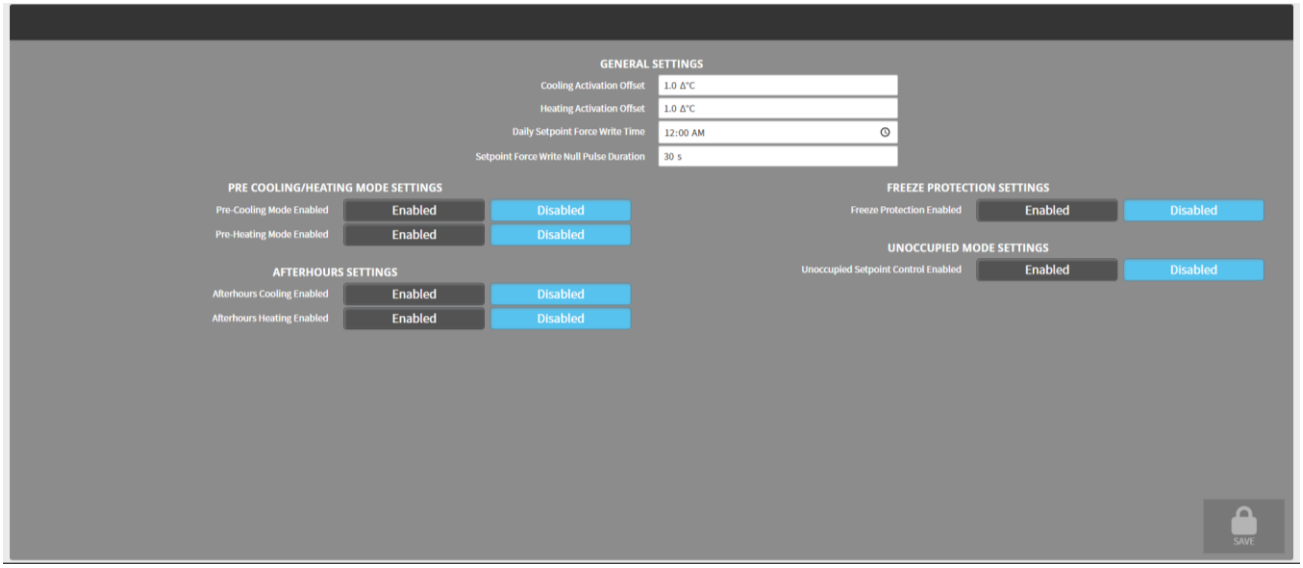


Figure 20 - Airside General Control Settings

5.1.1 General Settings

Parameters	Description	Units
Cooling Activation Offset	Temperature offset from cooling setpoint used to activate the Endpoint Equipment cooling mode. (for 4 pipe systems)	Δ°C
Heating Activation Offset	Temperature offset from heating setpoint used to activate the Endpoint Equipment heating mode. (for 4 pipe systems)	Δ°C
Daily Setpoint Force Write Time	Time of the day at which the heating/cooling temperature setpoints are reset to the values configured. This is to overwrite temperature setpoints changes made by users at the local controller level.	
Setpoint Force Write Null Pulse Duration	The period of time null is sent for at Daily Setpoint Force Write Time, before reverting back to controls.	

Table 3 – Airside Control - Setting

5.1.2 Pre Cooling/Heating Mode Settings

Optional Pre-Cooling and Pre-Heating modes that will start Endpoint Equipment before the occupied schedule indicates to do so in order to precondition (resp. cool or heat) the air for tenant comfort and to avoid peak usage at the start of the Schedule ON period.

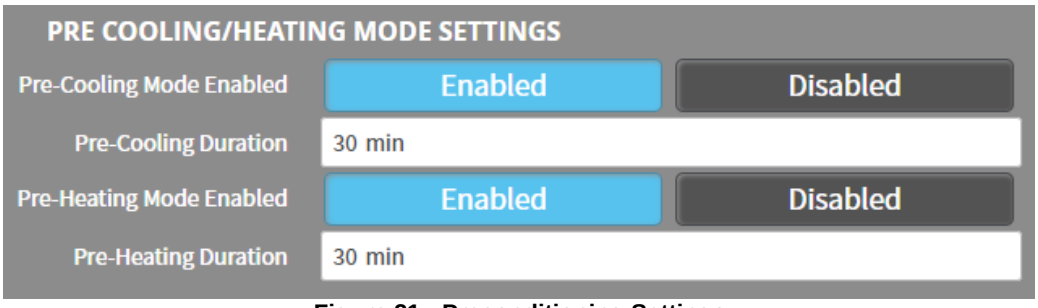


Figure 21 - Preconditioning Settings

Parameters	Description
Pre-Cooling/Pre-Heating Duration	The duration in minutes that the system should enable the cooling or heating mode prior to the scheduled ON time.

5.1.3 Afterhours Settings

Optional mode to control the temperature outside of the scheduled operation hours.

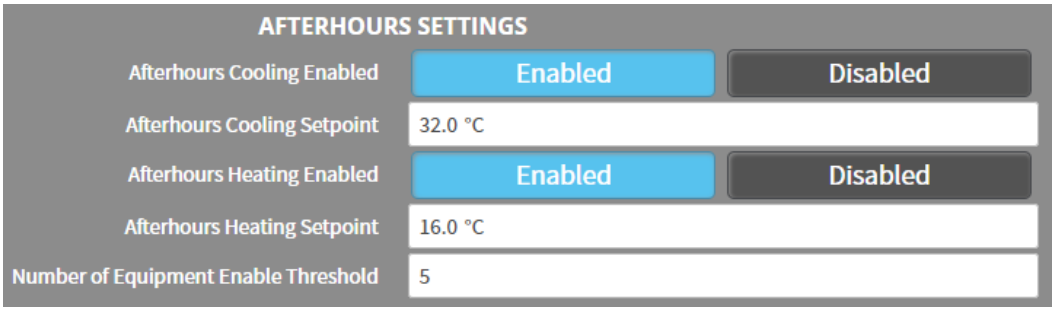


Figure 22 - Afterhours Settings

Parameters	Description	Units
Afterhours Cooling/Heating Setpoint	The cooling and heating setpoints the system should be controlled to outside of scheduled operating hours.	°C
Number of Equipment Enable Threshold	The number of equipment threshold (N) to trigger the mode controls. E.g. Heating: If any N Endpoint Equipment (or all Endpoint Equipment if fewer than N) in the Zone fall below their Afterhours Heating Setpoint. Cooling: If any N Endpoint Equipment (or all Endpoint Equipment if fewer than N) in the Zone exceed their Afterhours Cooling Setpoint.	

5.1.4 Freeze Protection Settings

Optional mode that triggers the heating mode if any of the Endpoint Equipment temperature sensors fall below the configured temperature setpoints.

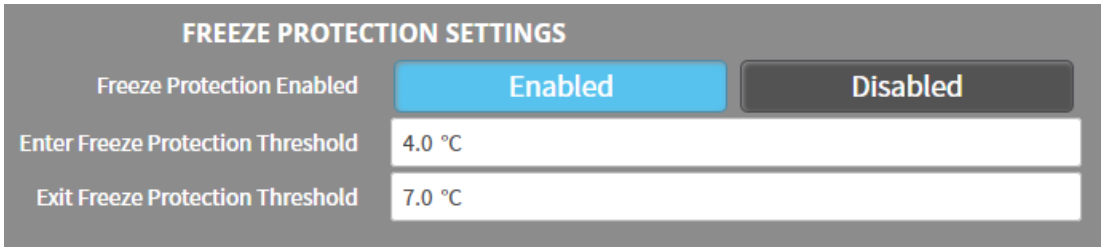


Figure 23 - Freeze Protection Settings

Parameters	Description	Units
Enter Freeze Protection Threshold	The temperature threshold that enables the freeze protection mode.	°C
Exit Freeze Protection Threshold	The temperature threshold that will trigger the freeze protection mode to end.	°C

5.1.5 Unoccupied Mode Settings

Optional mode that resets the cooling or heating temperature setpoint in each zone based off an occupancy sensor in order to save energy during the occupied schedule ON period.

This optional mode requires zone occupancy sensors in order to function correctly.

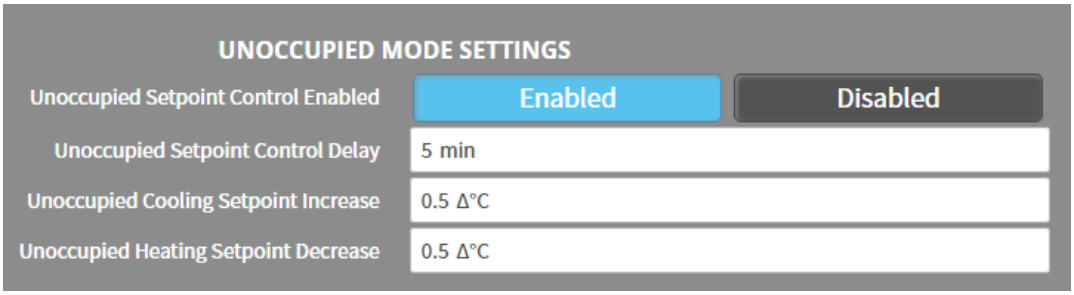


Figure 24- Unoccupied Mode Settings

Parameter	Description	Units
Unoccupied Setpoint Control Delay	Time delta in minutes from the moment the occupancy sensor signals that the zone is unoccupied after which the mode should be started.	
Unoccupied Cooling Setpoint Increase	The temperature delta the cooling setpoint should be increased by when entering the mode.	Δ°C
Unoccupied Heating Setpoint Decrease	The temperature delta the heating setpoint should be decreased by when entering the mode.	Δ°C

5.2 Supervisory Controls Settings

Users can select and configure cooling and heating call strategies by selecting an option from a drop-down. The following options are available:

- Disabled
- Trim Response
- Weighted Average

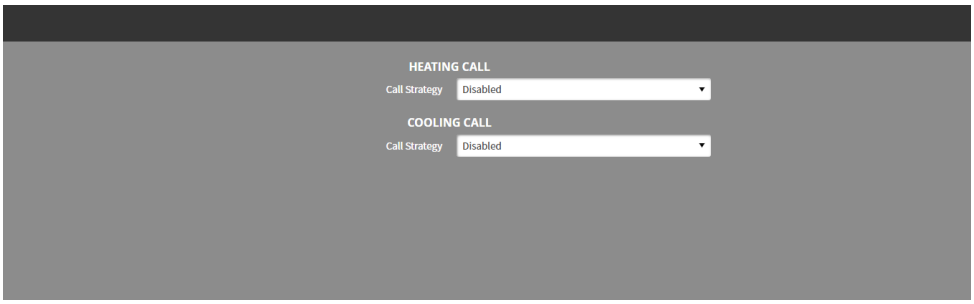


Figure 25 - Airside Supervisory Control

5.2.1 Cooling/Heating Call Trim Response Strategy

This strategy works as follows:
A Cooling/Heating call will be activated or deactivated, if a number of equipment running in the relevant mode have a load approximation above or below a threshold for longer than a delay.

The load approximation of an airside equipment is considered by default as the valve position.

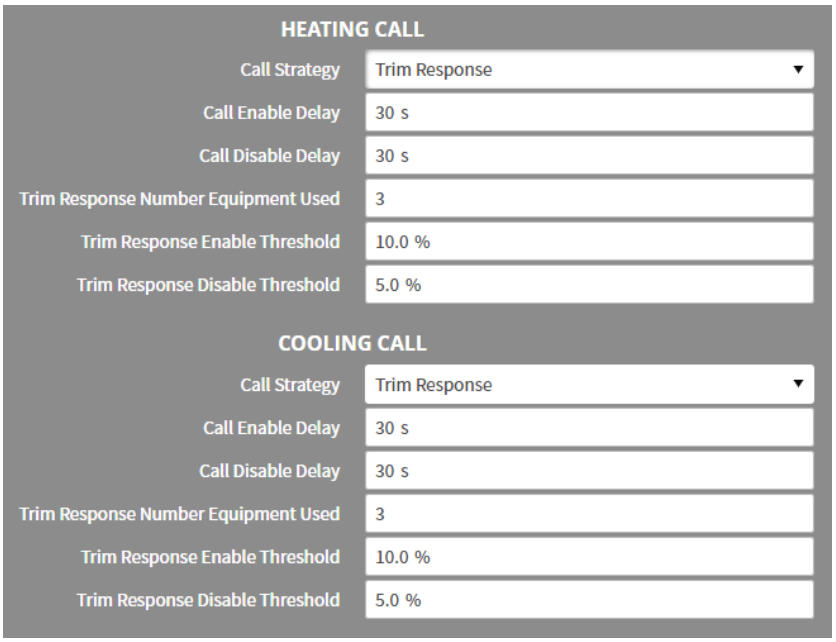


Figure 26 Call Calculation as Trim Response

Parameter	Description
Call Enable Delay	The time in seconds for which the call enable logic has to be true for before the call is enabled.
Call Disable Delay	The time in seconds for which the call disable logic has to be true for before the call is disabled.
Trim Response Number Equipment Used	The number of equipment with the highest load approximation (%) to check.
Trim Response Enable Threshold	Load approximation threshold at which the cooling/heating call will be enabled.
Trim Response Disable Threshold	Load approximation threshold at which the cooling/heating call will be disabled.

Table 4 - Airside – Trim Call - Setting

5.2.2 Cooling/Heating Call Weighted Average Strategy

This strategy works as follows:
A Cooling/Heating call is activated or deactivated if the weighted average of load approximations among endpoint equipment running in the relevant mode is above or below a threshold for longer than a delay.

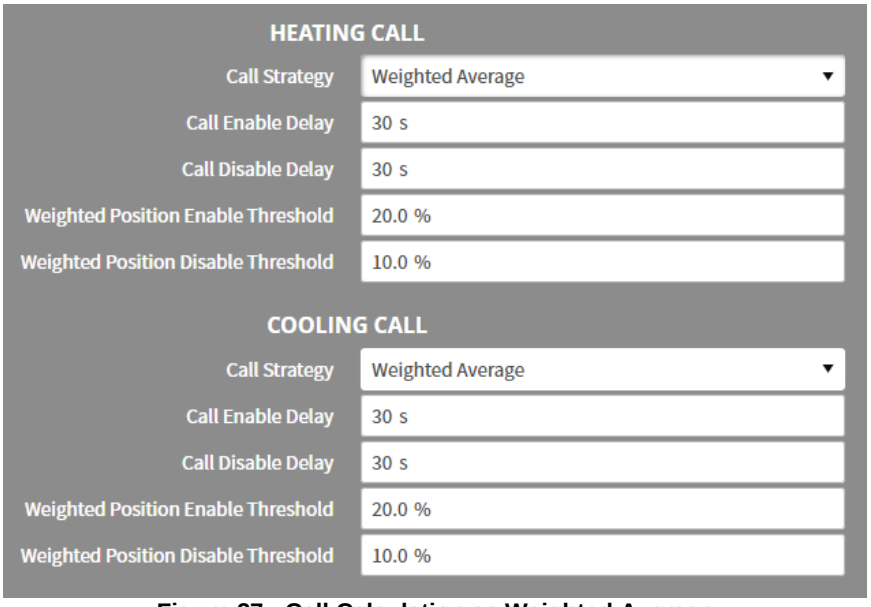


Figure 27 - Call Calculation as Weighted Average

Parameter	Description
`Call Enable Delay`	The time in seconds for which the call enable logic has to be true for before the call is enabled.
`Call Disable Delay`	The time in seconds for which the call disable logic has to be true for before the call is disabled.
`Weighted Position Enable Threshold`	Threshold for the calculated average load approximation at which the cooling/heating call will be enabled.
`Weighted Position Disable Threshold`	Threshold for the calculated average load approximation at which the cooling/heating call will be disabled.

Table 5 - Airside - Weighed Call - Setting

5.3 Allowed Mode Settings

In the Allowed Mode Configuration page, for each time period, a user can configure

a) a basic period, where a single mode can be chosen to be the mode for the whole period (for example heating only in winter),
b) a changeover period, where the allowed mode changes depending on the Outside Air Temperature (OAT).

The allowed mode will be applied to whole HVAC system (Units, and air side equipment).
Allowed mode can be configured in SmartControlSystem by navigating to the Allowed Mode menu from the Main Menu.

5.3.1 Allowed mode Configuration

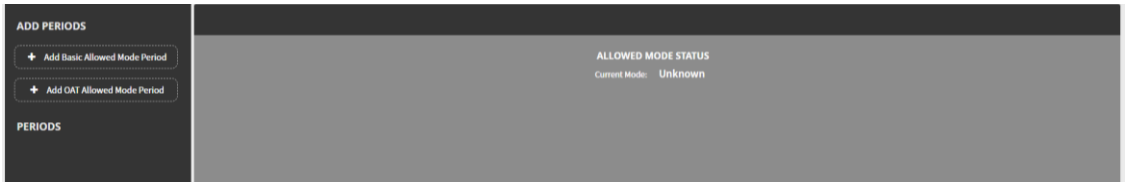


Figure 28 - Allowed Mode Configuration

To add the Basic Allowed Mode Period, click `Add Basic Allowed Mode Period` button.

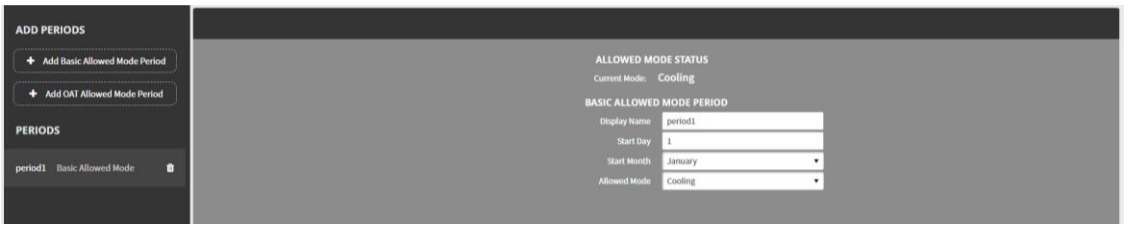


Figure 29 - Basic Allowed Mode Period

Basic Allowed Mode Period parameter	
Parameter	**Description**
Display Name	The name of the period
Start Day	The day to start
Start Month	The month to start
Allowed Mode	The modes that are allowed which it could be cooling, heating or unknown

Table 6 - System Mode - Basic period - Setting

To add the OAT Allowed Mode Period, click Add OAT Allowed Mode Period button.

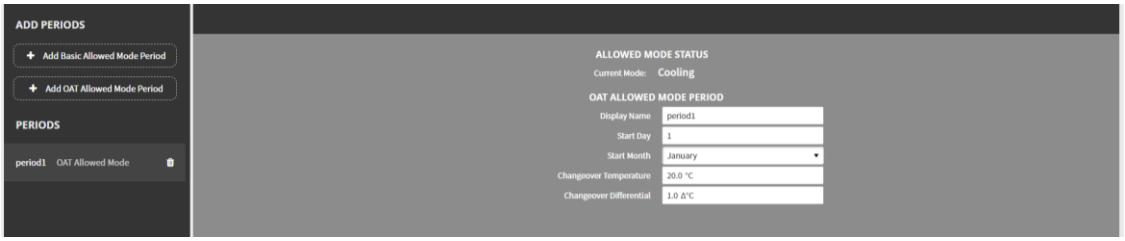


Figure 30 - Changeover Allowed Mode Period

OAT Allowed Mode Period Design Data		
Parameter	**Specification Description**	**Units**
Display Name	The name of period	
Start Day	The day to start	
Start Month	The month to start	
Changeover Temperature	Changeover value around which the 2-pipe system changes mode between cooling-only allowed and heating-only allowed	°C
Changeover Differential	Deadband around the OAT changeover temperature to account for minor fluctuations in the OAT	Δ°C

Table 7 - System Mode - OAT period - Setting

5.4 Stager Settings

In the Stager menu, configuration of the sequencing can be chosen among multiple different algorithms

- Fixed: Fixed sequencing for single water production (only cooling)
- Runtime Balancing: sequencing based on unit run hour balancing for single water production (only cooling)
- Dual Production – Fixed: Fixed sequencing for mixed water production (Cooling or Heating)
- Dual Production – Runtime Balancing: sequencing based on unit run hour balancing for mixed water production (Cooling or Heating)

The selection between Fixed and Runtime Balancing have an impact on the Sequencer setting menu

Configuration of Staging/Sequencing algorithm is RunTime Balancing by default. This configuration grants a longer life-time cycle of the units.

The other parameters on the Stager menu have an impact on the Staging conditions and they should be fine-tuned during the commissioning.

Staging parameters are slightly different between Single and Dual water production, because they reflect different staging conditions.

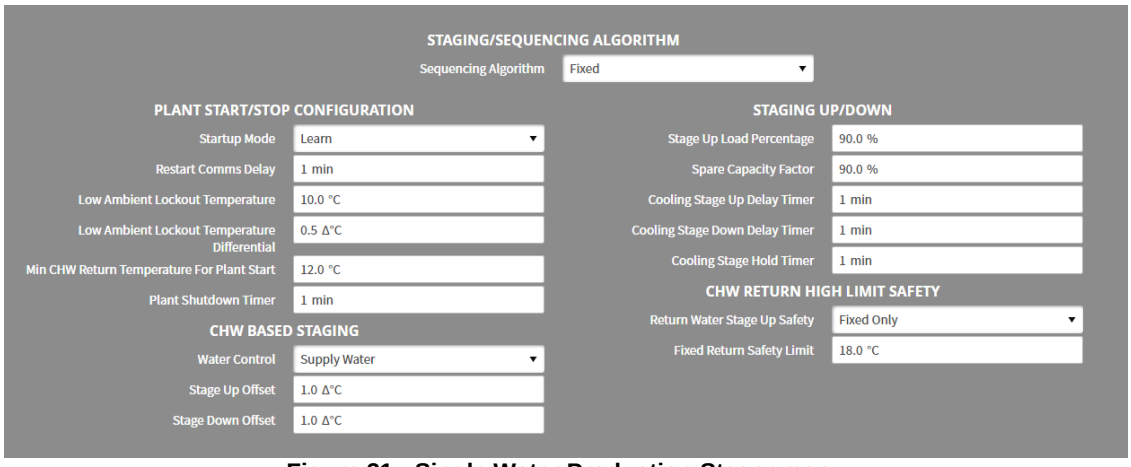


Figure 31 - Single Water Production Stager menu

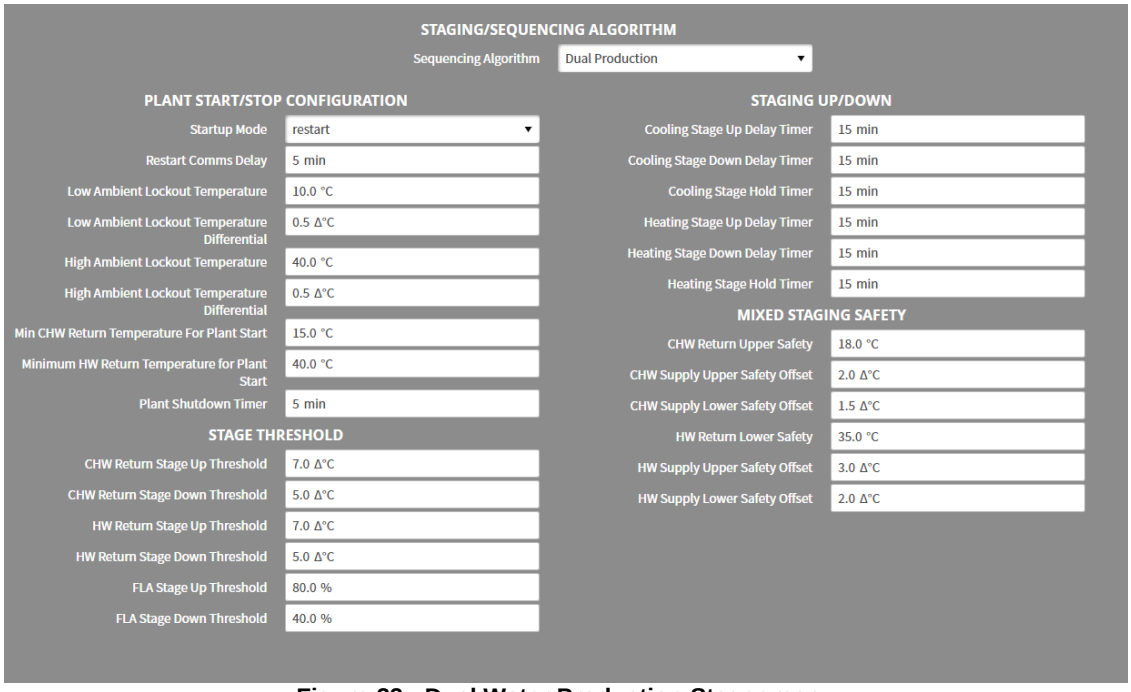


Figure 32 - Dual Water Production Stager menu

5.4.1 Plant Start/Stop Configuration

Plant Start/Stop Configuration Parameters		
Parameter	**Description**	**Recommended Setting**
`Start Up Mode`	There are two available modes to select: `Restart Mode` - upon restart of SmartControlSystem, SmartControlSystem will synchronise communication with field devices and then shut down the entire plant and restart. `Learn Mode` - upon restart of SmartControlSystem, SmartControlSystem will synchronise communication with field devices, learn current running status of plant equipment and continue controlling the plant based on current running status.	
`Restart Comms Delay`	The time that SmartControlSystem waits upon a restart in order to synchronise communication with field devices	
`Low Ambient Lockout Temperature`	As one of the Plant Start Conditions, Actual Ambient Temperature must be **higher** than Low Ambient `Lockout Temperature + Lockout Differential`.	In low humidity and cooler areas, if the site has active economy cycle, the ambient lockout temperature can be set to a

Plant Start/Stop Configuration Parameters		
	Plant will stop when Current Ambient Temperature < Low Ambient Lockout Temperature - Lockout Deviation	relatively high value (for example 15+ °C) for maximum efficiency gains.
Low Ambient Lockout Temperature Differential	This provides a deadband around the ambient lockout temperature. This deadband ensures that the plant is started only when the ambient temperature has consistently remained above ambient lockout temperature. It also ensures that the plant is placed into ambient lockout only if the ambient temperature has consistently remained below ambient lockout temperature.	This parameter can be left at the default of 0.5 Δ°C
High Ambient Lockout Temperature	As one of the Plant Start Conditions, actual Ambient Temperature must be **lower** than High Ambient Lockout Temperature + Lockout Differential. Plant will stop when Current Ambient Temperature > High Ambient Lockout Temperature - Lockout Deviation	
High Ambient Lockout Temperature Differential	This provides a deadband around the ambient lockout temperature. This deadband ensures that the plant is started only when the ambient temperature has consistently remained above ambient lockout temperature. It also ensures that the plant is placed into ambient lockout only if the ambient temperature has consistently remained above ambient lockout temperature.	This parameter can be left at the default of 0.5 Δ°C
Minimum CHW Return Temperature for Plant Start	As one of the Plant Start Conditions, CHW Return Temperature must be **higher** than this value. Once the plant has started, SmartControlSystem will NOT stop the plant based on this point. In other words, this point is only effective for plant start-up process.	This effectively provides a Stage Zero - Pump Only stage. The higher this value the longer the plant will run in the pump only stage before enabling the chillers.
Minimum HW Return Temperature for Plant Start	As one of the Plant Start Conditions, HW Return Temperature must be **lower** than this value. Once the plant has started, SmartControlSystem will NOT stop the plant based on this point. In other words, this point is only effective for plant start-up process.	This effectively provides a Stage Zero - Pump Only stage. The lower this value the longer the plant will run in the pump only stage before enabling the chillers.
Plant Shutdown Timer	The Plant Shutdown timer ensures that chiller plant short cycling does not occur. The plant will not be restarted (regardless of other start conditions) until after the full duration of the shutdown timer. When a plant is completely shut down, this time will start to count down. The plant will NOT restart until this timer runs out or be manually cleared.	This parameter should be set based on the urgency of cooling for a chiller plant. For example, if the chiller plant is cooling important equipment you may set the shut down timer very short (5 minutes) or if space cooling for non-critical applications is being undertaken by the chiller plant a shut down time of ~20 minutes may be ideal.

Table 8 - Single Production - Plant Start/Stop Setting

5.4.2 Single Water Production - Staging Up/Down

Parameter	Description	Recommended Setting
Stage Up Load Percentage	As one of the Staging Up Conditions, Current Plant Load must be **higher** than Stage Up Load Percentage * Running Chillers' Total Cooling Capacity	This value is typically set to 90%. The higher the stage up load percentage the longer is the stage up event delayed.
Spare Capacity Factor	As one of the Staging Down Conditions, Active Load of the Next-OFF chiller must be **lower** than Spare Capacity Factor * (Sum of the Spare Capacity of the remaining chillers)	This value is typically set to 80%. The lower this value, the more delayed a stage down event will be.
Cooling Stage Up Delay Timer	To stage up, all Staging Up Cooling Conditions must be satisfied continuously for the amount of time configured in this timer.	This value is typically set to 5 - 20 mins.

Parameter	Description	Recommended Setting
Cooling Stage Down Delay Timer	To stage down, all Staging Down Cooling Conditions must be satisfied continuously for the amount of time configured in this timer.	This value is typically set to 5 - 15 mins.
Cooling Stage Hold Timer	After performing a staging action, SmartControlSystem will hold the current cooling stage for the amount of time configured in this timer.	This timer should be long enough to allow for the chillers to load up. Typically this stage hold or settle timer is set to 15 - 20 mins.

Table 9 - Single Production - Staging Settings

5.4.3 Single Water Production - CHW Based Staging

Parameter	Description	Recommended Setting
Stage Up Offset	As one of the Staging Up Conditions, Supply CHW Temperature must be **higher** than (Supply CHW Setpoint + Stage Up Offset)	Typically this value is set between 0.5 and 2.0 Δ°C . The larger this value, the more delayed the stage up event will be.
Stage Down Offset	As one of the Staging Down Conditions, Supply CHW Temperature must be **lower** than (Supply CHW Setpoint + Supply Stage Down Offset)	Typically this value is set to a degree below the split between the design entering and leaving chilled water temperature of the chillers. (Assuming all chillers have the same split)

5.4.3.1 Return CHW Based Staging

Select Return Water in the drop-down menu of Water Control to enable Return CHW Based Staging.

Parameter	Description	Recommended Setting
Return Stage Up Offset	As one of the Staging Up Conditions, Return CHW Temperature must be **higher** than (Supply CHW Setpoint + Return Stage Up Offset)	Typically this value is set to 1 degree above the split between the design entering and leaving chilled water temperature of the chillers. (Assuming all chillers have the same split) In cases where the chillers have differing splits, supply water based control may be more suitable.
Return Stage Down Offset	As one of the Staging Down Conditions, Return CHW Temperature must be **lower** than (Supply CHW Setpoint + Return Stage Down Offset)	Typically this value is set to a degree below the split between the design entering and leaving chilled water temperature of the chillers. (Assuming all chillers have the same split)

5.4.4 Single Water Production - CHW Return High Limit Safety

Two different types of High Limit Safety are available - Fixed and Dynamic and Fixed Only.

	***CHW Return High Limit Safety* is a safety mechanism which prevents the plant CHW temperature from increasing too high. Once *CHW Return Temperature* reaches *CHW Return High Limit Safety*, SmartControlSystem will initiate a staging-up event.**

5.4.4.1 Fixed and Dynamic

When Fixed and Dynamic is enabled, both Fixed and Dynamic Return CHW High Limit Safety take effect.
Select Fixed and Dynamic in the drop-down menu of Return Water Stage Up Safety to enable Fixed and Dynamic.

Parameter	Description	Example (if applicable)
Offset Above CHW SP	When Return CHW Temperature is **higher** than (Supply CHW Setpoint + Offset Above CHW SP) for a period of the stage up timer, SmartControlSystem will initiate a staging-up event.	Supply CHW Setpoint is 6 deg C and Offset Above SP is set to 10 deg C. When CHW Return Temperature is higher than 16 deg C (=6+10), SmartControlSystem will initiate a staging-up event.
Fixed Return Safety Limit	When Return CHW Temperature is **higher** than Fixed Return Safety Limit for a period of the stage up timer, SmartControlSystem will initiate a staging-up event.	Fixed Return Safety Limit is set to 18 deg C. When CHW Return Temperature is higher than 18 deg C (Fixed Return Safety Limit), SmartControlSystem will initiate a staging-up event.

5.4.4.2 Fixed Only

When Fixed is enabled, only Fixed Return CHW High Limit Safety takes effect.
Select **Fixed Only** in the drop-down menu of Return Water Stage Up Safety to enable **Fixed Only**.

Parameter	Description	Example (if applicable)
Fixed Return Safety Limit	When Return CHW Temperature is **higher** than Fixed Return Safety Limit for a period of the stage up timer, SmartControlSystem will initiate a staging-up event.	Supply CHW Setpoint is 6 deg C and Fixed Return Safety Limit is set to 18 deg C. When CHW Return Temperature is higher than 18 deg C (Fixed Return Safety Limit), SmartControlSystem will initiate a staging-up event.

5.4.5 Dual Water Production - Stage Threshold

Parameter	Description	Recommended Setting
CHW Return Stage Up Threshold	This determines the CHW Return Temperature Setpoint for staging up cooling. CHW Return Temperature Setpoint = CHW SP + CHW Return Stage Up Threshold	Typically this value is set to 7 Δ°C . The larger this value, the more delayed the stage up event will be.
CHW Return Stage Down Threshold	This determines the CHW Return Temperature Setpoint for staging down cooling. CHW Return Temperature Setpoint = CHW SP + CHW Return Stage Down Threshold	Typically this value is set to 5 Δ°C . The larger this value, the faster the stage down event will be.
HW Return Stage Up Threshold	This determines the HW Return Temperature Setpoint for staging up heating. HW Return Temperature Setpoint = HW SP – HW Return Stage Up Threshold	Typically this value is set to 7 Δ°C . The larger this value, the more delayed the stage up event will be.
HW Return Stage Down Threshold	This determines the HW Return Temperature Setpoint for staging down heating. HW Return Temperature Setpoint = HW SP – HW Return Stage Down Threshold	Typically this value is set to 5 Δ°C . The larger this value, the faster the stage down event will be.
FLA Stage Up Threshold	A Stage Up Condition is reached when EITHER calcPlantPercFLA_cooling OR calcPlant PercFLA_heating reaches the FLA% Stage Up Threshold value.	Typically this value is set to 80%.
FLA Stage Down Threshold	A Stage Down Condition is reached when EITHER calcPlantPercFLA_cooling OR calcPlant PercFLA_heating reaches the FLA% Stage Down Threshold value.	Typically this value is set to 40%
Plant Shutdown Timer	The Plant Shutdown timer ensures that chiller plant short cycling does not occur. The plant will not be restarted (regardless of other start conditions) until after the full duration of the shutdown timer. When a plant is completely shut down, this time will start to count down. The plant will NOT restart until this timer runs out or be manually cleared.	This parameter should be set based on the urgency of cooling for a chiller plant. For example, if the chiller plant is cooling important equipment you may set the shut down timer very short (5 minutes) or if space cooling for non-critical applications is being undertaken by the chiller plant a shut down time of ~20 minutes may be ideal.

Table 10 - Dual Production - Staging Thresholds - Setting

5.4.6 Dual Water Production - Staging Up/Down

Parameter	Description	Recommended Setting
Cooling Stage Up Delay Timer	To stage up, all Staging Up Cooling Conditions must be satisfied continuously for the amount of time configured in this timer.	This value is typically set to 5 - 20 mins.
Cooling Stage Down Delay Timer	To stage down, all Staging Down Cooling Conditions must be satisfied continuously for the amount of time configured in this timer.	This value is typically set to 5 - 15 mins.
Cooling Stage Hold Timer	After performing a staging action, SmartControlSystem will hold the current cooling stage for the amount of time configured in this timer.	This timer should be long enough to allow for the chillers to load up. Typically this stage hold or settle timer is set to 15 - 20 mins.

Parameter	Description	Recommended Setting
Heating Stage Up Delay Timer	To stage up, all Staging Up Heating Conditions must be satisfied continuously for the amount of time configured in this timer.	This value is typically set to 5 - 20 mins.
Heating Stage Down Delay Timer	To stage down, all Staging Down Heating Conditions must be satisfied continuously for the amount of time configured in this timer.	This value is typically set to 5 - 15 mins.
Heating Stage Hold Timer	After performing a staging action, SmartControlSystem will hold the current heating stage for the amount of time configured in this timer.	This timer should be long enough to allow for the chillers to load up. Typically this stage hold or settle timer is set to 15 - 20 mins.

Table 11 - Dual Production - Staging - Setting

5.4.7 Mixed Staging Safety

Parameter	Description	Recommended Setting
CHW Return Upper Safety Limit	This is the high CHW return temperature safety limit for staging up. When this limit is reached, plant electrical load is disregarded and a stage up cooling condition is reached.	This setpoint should be set at least 3°C higher than CHW Return temperature to avoid unnecessary Stage Up
CHW Supply Upper Safety Offset Limit	This is the high CHW supply temperature safety limit for staging up. When this limit is reached, plant electrical load is disregarded and a stage up cooling condition is reached.	
CHW Supply Lower Safety Offset Limit	This is the low CHW supply temperature safety limit for staging down. When this limit is reached, plant electrical load is disregarded and a stage down cooling condition is reached.	
HW Return Lower Safety Limit	This is the high HW return temperature safety limit for staging up. When this limit is reached, plant electrical load is disregarded and a stage up heating condition is reached.	This setpoint should be set at least 3°C lower than HW Return temperature to avoid unnecessary Stage Up
HW Supply Upper Safety Offset Limit	This is the high HW supply temperature safety limit for staging up. When this limit is reached, plant electrical load is disregarded and a stage up heating condition is reached.	
HW Supply Lower Safety Offset Limit	This is the low HW supply temperature safety limit for staging down. When this limit is reached, plant electrical load is disregarded and a stage down heating condition is reached.	

5.5 Smart Defrost Configuration

In the Smart Defrost Configuration page, the user can configure the smart defrost feature which will activate defrost mode in machines that are set to support defrost mode to prevent freezing of their air exchanger coils.
This is only available for Air-source Reversible Heat Pumps.
When a request from the heat pump is received to enter defrost mode, a command can be send back to the unit to allow defrost mode. In all other scenarios, the defrost is disallowed.
The Inhibit Time Duration can be set on this page to specify the maximum allowable delay after a defrost requirement is received before the air reversible heat pump is forced to enter defrost mode, if at least another heat pump is already in defrost mode. The purpose of this inhibit time is to reduce the occurrence of most or all the units running in defrost mode at the same time. However, even if the other heat pump(s) are still in defrost mode, after the inhibit time, the heat pump is still allowed to enter defrost mode.
Smart Defrost can be configured by navigating to the Stager - Smart Defrost page from the Main Menu.

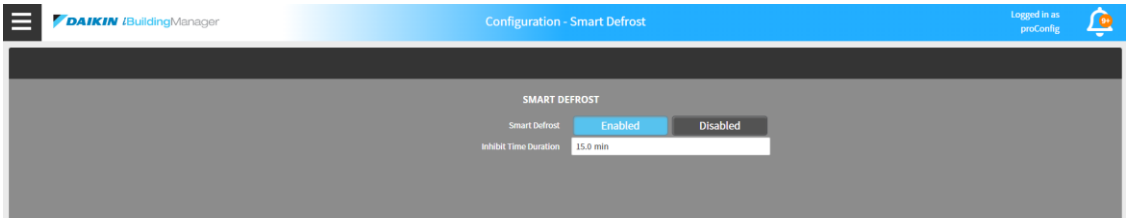


Figure 33 - Smart Defrost Settings

Parameter	Description	Units
Smart Defrost	To enable or disable the Smart Defrost feature	
Inhibit Time Duration	Sets the maximum delay time allowed after a defrost requirement is received before the unit is allowed to enter defrost mode	min

5.6 Sequencing Settings

In Sequencing Settings page, users can configure certain sequences to stage up/down Chiller units and Hea Pump units.

> ***Please ensure that all Units have been added and configured before configuring sequencer.***
> ***Please ensure that no Unit is running when configuring Sequencer***

To access this page, select the Sequence Configuration option under Sequencing in the Main Menu.

5.6.1 Fixed Sequencing

In Fixed Sequencing, SmartControlSystem stages up/down units in a fixed sequence that can be configured by the user. The fixed sequencing screen can be found below.

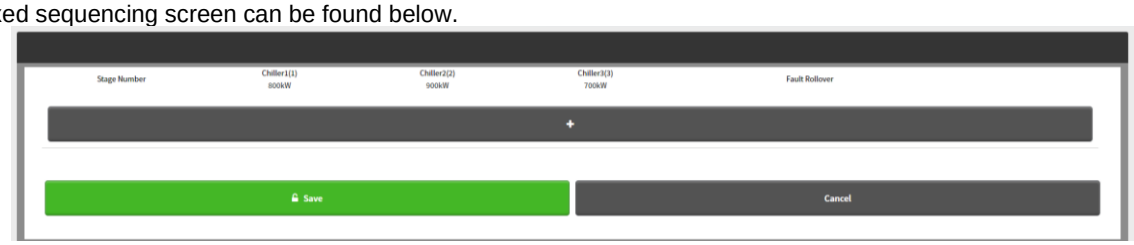


Figure 34 - Fixed Sequencing Settings

5.6.1.1 Adding a Sequence

To add a stage, press "+" button and select the desired chillers. Press Save button to save any changes.
Each stage must respect the following conditions:

> ***1) The total cooling capacity of next stage must be higher than that of current stage.***
> ***2) The number of chillers selected of next stage can be only one more than that of current stage.***

User should add as many stages as the number of units.

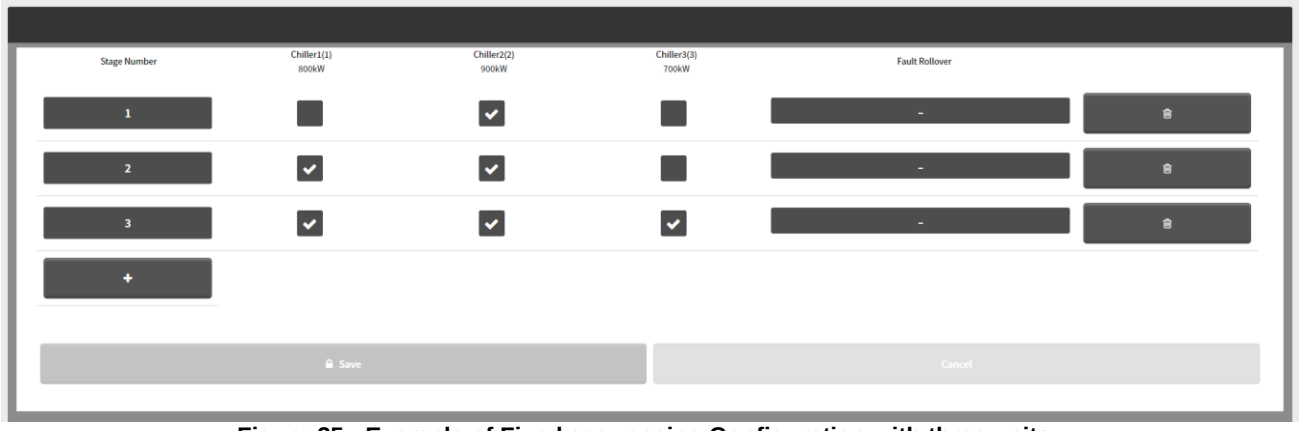


Figure 35 - Example of Fixed sequencing Configuration with three units

5.6.1.2 Set Fault Rollover Sequence

For each stage, user can configure the unit that will replace the one that suffer a shut-down alarm.
To configure fault-rollover Units, manually enter the required fault-rollover Unit number under the Fault Rollover section of each sequence.
When a Chiller/Unit fault occurs in any sequence, SmartControlSystem start the Units nominated in the Fault Rollover section of that particular sequence.

5.6.2 Runtime Balancing

In Runtime Balancing Sequencing, SmartControlSystem calculates a priority order based on the unit's run hours when triggered by a calendar event or by a fixed interval.
Every time the recalculation occurs, the units will be ordered based on run hours from lowest to highest at that point in time.

The new calculated sequence will be used on the plant when the plant starts, a stage up or down event occurs, or a unit fault occurs, unless the user sets `Force action new sequence on calculation` to true. In this case, the plant will force the running chillers to change to the new order upon its calculation. The Runtime Balancing screen can be found in the figure below

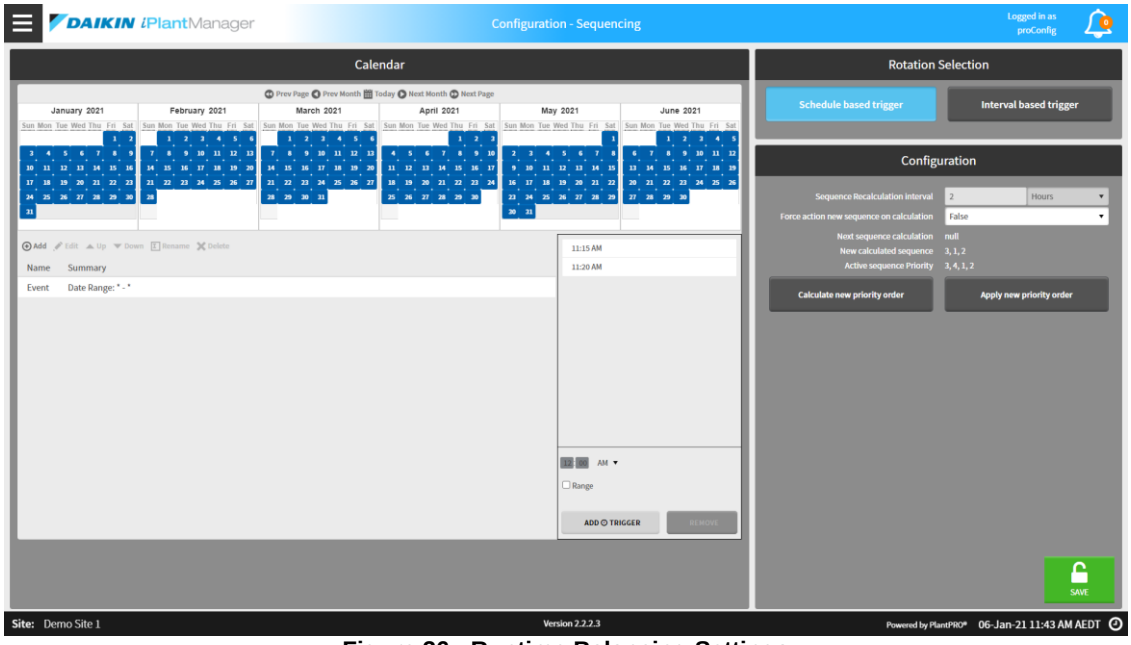


Figure 36 - Runtime Balancing Settings

5.6.2.1 Schedule based trigger

When set to schedule based trigger, the user can configure when the sequence is recalculated via a calendar. Events can be added by pressing the `add` button

5.6.2.2 Interval based trigger

When set to interval based trigger, the user can configure the interval period in either hours or days. The sequence will then be recalculated when this interval expires. If the user manually triggers a recalculation, the next calculation time will automatically update to occur after one interval period from that time.

5.6.2.3 Forcing staging recalculation

The user is also able to:

- Have the new sequence be applied immediately by choosing the option `Force action new sequence on calculation` when a new sequence priority order calculation occurs.
- Calculate a new priority order for the Units by pressing the respective button. This will be reflected in the field New calculated sequence.
- Apply the new priority order for the Units by pressing the respective button. This will be reflected in the field `Active sequence Priority.`

If the Apply new priority order button is pressed, this may result in any currently running chillers to turn off in order for the new sequence to be applied.

5.7 Sequence Transition Settings

In `Sequence Transition` page, user can set timers to stabilize the transition of each units.
A unit transition duration is the time that a unit take to change in the run status as a consequence of SmartControlSystem command.
To access this page, select the Sequence Transitions under `Sequencing` in the Main Menu.

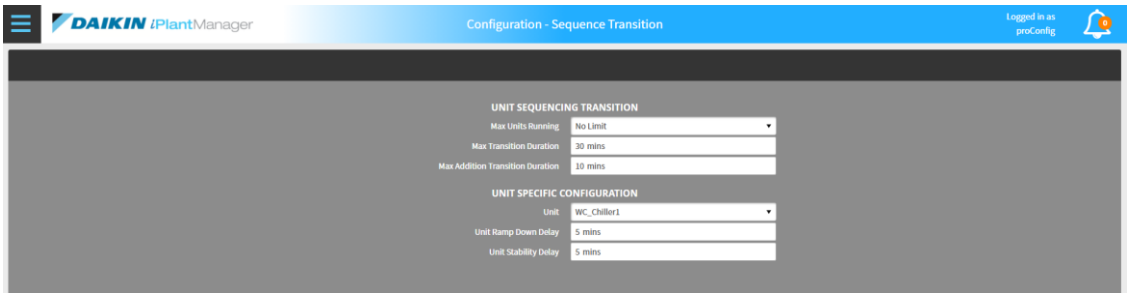


Figure 37 - Sequence Transition Settings

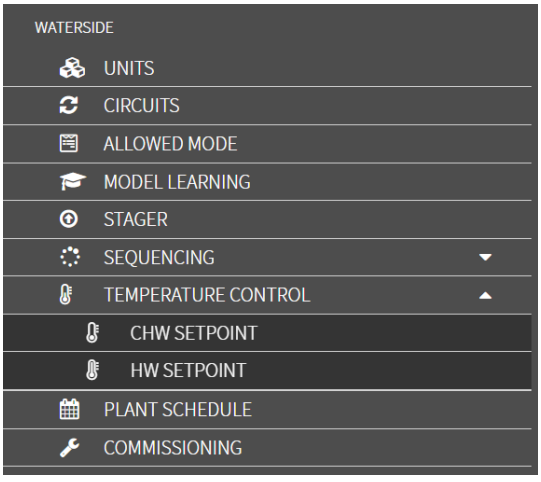
The following parameter can be configured for Sequence Transition

Parameter Name	Description
`Max Units Running`	The maximum number of units that can run at any given time. If so to 'No Limit' then there is no limitation on this.
`Max Transition Duration`	The maximum amount of time in minutes that consecutive transitions can take before all transitions are force completed.
`Max Addition Transition Duration`	The maximum amount of time in minutes that enabling a unit can take before the transition is force completed
`Unit`	The selected unit for configuration. Each unit can have a different configuration.
`Unit Ramp Down Delay`	The time in minutes that the sequencer will wait for the given unit to ramp down after it is disabled
`Unit Stability Delay`	The time in minutes that the sequencer will wait after the unit reports an active run status before ending the transition.

Table 12 - Unit Transitions Setting

5.8 Temperature Control Configuration

Users can select and configure CHW/HW Setpoint control strategies by selecting an option from a drop-down.



HW setpoint menu will display only if staging/sequencing algorithm (in the menu Stager - Configuration) is set as “Dual Water Production”.

5.8.1 HW Setpoint Control Strategy

The user can select between the following Setpoint control Strategy:

- `Fixed`: non control strategy
- Reset based on Return Temperature

- Reset based on Outside Air Temperature

To select HW Return Temperature Reset, simply select `Reset off Return Temperature` in the drop-down menu of Control Strategy for Hot Water.
Modify the configurations and press the `Save` button.
To enable the `Seasonal Mode`, click enable button and press the `Save` button

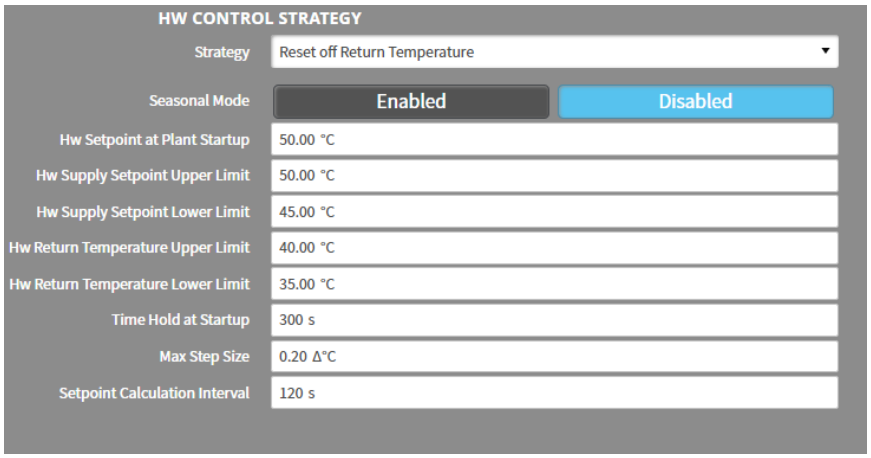


Figure 38 - Hot Water Setpoint Reset based on RetT

To select HW Outside Air Temperature Reset, simply select `Reset off Outside Air Temperature` in the drop-down menu of `Control Strategy` for Hot Water. Modify the configurations and press `Save` button.

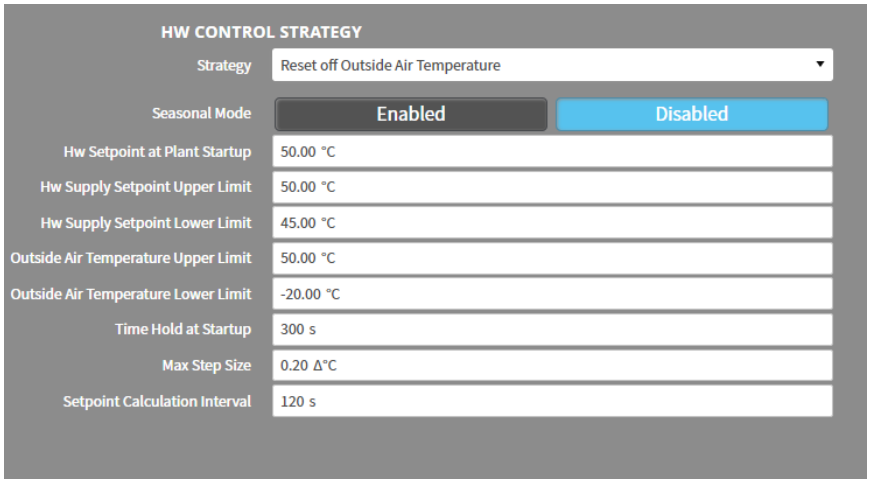


Figure 39 - Hot Water Setpoint Reset based on OaT

HW Return Temperature/Outside Air Temperature Reset Configuration Parameters		
Parameter Name	**Description**	**Units**
HW Setpoint at Plant Startup (Summer/Winter/Default)	The predefined value of the HW Setpoint as soon as the Plant Run Required is true (value can be set differently by enabling season mode).	°C
Time holds at startup	How long the initial plant start-up setpoint value should be held.	sec
HW Setpoint Upper Limit (Summer/Winter/Default)	The maximum allowable hot water supply temperature setpoint (value can be set differently by enabling season mode).	°C
HW Setpoint Lower Limit (Summer/Winter/Default)	The minimum allowable hot water supply temperature setpoint (value can be set differently by enabling season mode).	°C
Outside Air Temperature Upper Limit (Summer/Winter/Default)	This is the upper limit for the hot water return temperature OR outside air temperature. At this limit, the HW Setpoint will be at the HW Setpoint Lower Limit (value can be set differently by enabling season mode).	°C
Outside Air Temperature Lower Limit (Summer/Winter/Default)	This is the lower limit for the hot water return temperature OR outside air temperature. At this limit, the HW Setpoint will be at the HW Setpoint Upper Limit (value can be set differently by enabling season mode).	°C

Max Step Size	Maximum allowable change step of hot water supply temperature setpoint.	Δ°C
Setpoint Calculation Interval	The frequency at which the HW Reset Calculation is carried out.	sec
Seasonal Mode	By enabling this, the user can save different settings of the above temperatures in terms of different seasons, by disabling this, the plant will apply the default settings	
Current Mode	The current mode used by the plant if the seasonal mode is enabled	
Season Configuration	This is a selection of which seasonal settings the user wants to configure	Summer/Winter
Season Start Month	The season started in which month	Months
Season Start Day	The season started on which day	Days

Table 13 - Hot Setpoint Reset - Setting

5.8.2 CHW setpoint control Strategy

The user can select between the following Setpoint control Strategy:

- Fixed: non control strategy
- Reset based on Return Temperature
- Reset based on Valve Position of the air side equipment

To select Reset based on Return Temperature, user needs to set CHW Return Temp Reset in the drop-down menu of Control Strategy for Chilled Water.

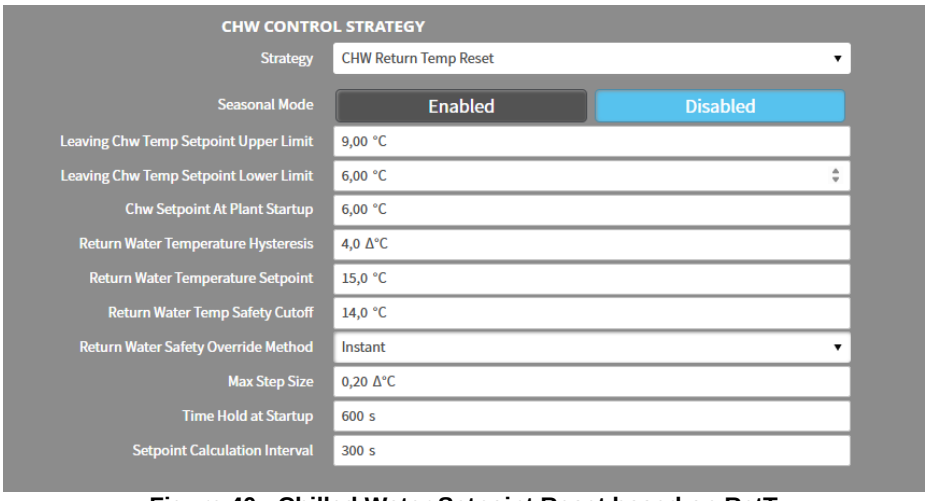


Figure 40 - Chilled Water Setpoint Reset based on RetT

CHW Return Temp Reset Configuration Parameters	
Parameter	**Description**
Setpoint At Plant Startup (Summer/Winter/Default)	The initial CHW Setpoint that SmartControlSystem will hold for a certain amount of time (Time Hold At Startup) during plant startup (Temperature value can be set differently by enabling season mode).
Setpoint Upper Limit (Summer/Winter/Default)	The maximum value of CHW Setpoint (Temperature value can be set differently by enabling season mode).
Setpoint Lower Limit (Summer/Winter/Default)	The minimum value of CHW Setpoint (Temperature value can be set differently by enabling season mode).
Return Water Temp Hysteresis (Summer/Winter/Default)	The maximum expected difference is below the upper limit of the Return Water Temperature Setpoint. This will define the lower limit and the expected range of the CHW Return Temperature.(Temperature value can be set differently by enabling season mode).
Return Water Temp Setpoint (Summer/Winter/Default)	The upper limit of the CHW Return Temperature (Temperature value can be set differently by enabling season mode).
Return Water Safety Cutoff (Summer/Winter/Default)	When CHW Return Temperature reaches Return Water Safety Cutoff+CHW Return Deadband, CHW Setpoint will be overridden to

CHW Return Temp Reset Configuration Parameters	
	Setpoint Lower Limit in a certain method (as configured in `Override Method`) (Temperature value can be set differently by enabling season mode).
`Return Water Safety Override Method`	When `CHW Return Temperature` reaches `Return Water Safety Cutoff+CHW Return Deadband`, `CHW Setpoint` will be set to Setpoint Lower Limit in the following method • `Standard Override`: Override is subject to Max Step Size and Calculation Interval. • `Fast Override`: Override is subject to Calculation Interval, but not Max Step Size. • `Instant Override`: Override will take effect instantly, regardless of Calculation Interval or `Max Step Size`. • `Smart Override`: Override is calculated based on the rate of change on CHW Return Temperature.
`Max Step Size`	The maximum change on CHW Setpoint in each calculation
`Time Hold At Startup`	The amount of time during which SmartControlSystem will hold CHW Setpoint at a certain value (Setpoint At Plant Startup)
`Calculation Interval`	The interval after which calculation is performed
`Season Mode`	By enabling this, the user can save different settings of the above temperatures in terms of different seasons, by disabling this, the plant will apply the default settings
`Current Mode`	The current mode used by the plant if the seasonal mode is enabled
`Season Configuration`	This is a selection of which seasonal settings the user wants to configure
`Season Start Month`	The season started in which month
`Season Start Day`	The season started on which day

Table 14 - Chilled Water Setpoint Reset on Return - Setting

To select Reset based on CHW Valve Position, select `CHW Valve Position Reset` in the drop-down menu of Control Strategy for Chilled Water.

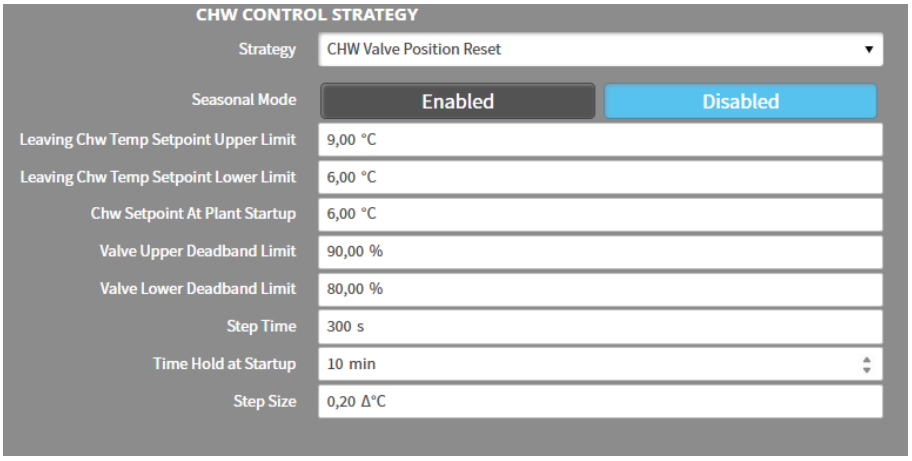


Figure 41 – Chilled Water Setpoint Reset based on Valve Positioning

CHW Valve Position Reset Configuration Parameters		
Parameter	**Description**	**Example (if applicable)**

`Setpoint At Plant Startup`
 	
`(Summer/Winter/Default)`
	The initial CHW Setpoint that SmartControlSystem will hold for a certain amount of time (`Time Hold At Startup`) during plant startup (Temperature value can be set differently by enabling season mode).	

`Time Hold At Startup`	The amount of time during which SCS will hold CHW Setpoint at a certain value (`Setpoint At Plant Startup`)	

`Setpoint Upper Limit`
 	
`(Summer/Winter/Default)`
	The maximum value of CHW Setpoint (Temperature value can be set differently by enabling season mode).	

CHW Valve Position Reset Configuration Parameters		
Setpoint Lower Limit (Summer/Winter/Default)	The minimum value of CHW Setpoint (Temperature value can be set differently by enabling season mode).	
Valve Deadband Upper Limit (Summer/Winter/Default)	The upper limit of valve position above which CHW Setpoint will decrease (Temperature value can be set differently by enabling season mode).	
Valve Deadband Lower Limit (Summer/Winter/Default)	The lower limit of valve position above which CHW Setpoint will increase (Temperature value can be set differently by enabling season mode).	
Step Time	The interval after which Step is perform if necessary	
Step Size	The maximum change on CHW Setpoint in each calculation.	Max Step Size is set to 0.1 deg C. Even though the calculation requires CHW Setpoint to increase by 1 deg C, the actual increase on CHW Setpoint is still 0.1 deg C.
Seasonal Mode	By enabling this, the user can save different settings of the above temperatures in terms of different seasons, by disabling this, the plant will apply the default settings	
Current Mode	The current mode used by the plant if the seasonal mode is enabled	
Seasonal Configuration	This is a selection of which seasonal settings the user wants to configure	
Season Start Month	The season started in which month	
Season Start Day	The season started on which day	

Table 15 Chilled Water Setpoint Reset on Valve position - Setting

5.8.2.1 CHW Setpoint Limits

This defines the individual CHW setpoint limits for each chiller, the plant setpoint will not be applied directly to the chiller but will instead undergo stepping logic & min/max limits defined in the configuration in this section. This will allow you to limit the chw setpoints allowed by certain chillers or allow them to change their setpoint on a longer than usual period without having to apply those settings to the entire plant.

Chiller CHW Setpoint Limits	
Parameter	**Description**
Chiller	The chiller to modify the setpoint limits for. Every other parameter will be dependent on the chiller selected here.
Min CHW Setpoint	The minimum CHW setpoint that can be applied to the given chiller.
Max CHW Setpoint	The maximum CHW setpoint that can be applied to the given chiller.
Step Time	The period of time which the chiller will hold the same setpoint before changing in seconds.
Max Step Size	The maximum amount that the CHW setpoint can change at the conclusion of the step time

5.9 Plant Schedule Setting

SmartControlSystem supports two schedule modes

1) User Defined Schedule,
2) Always On

Schedule modes can be switched in the Schedule Mode panel on right hand side.

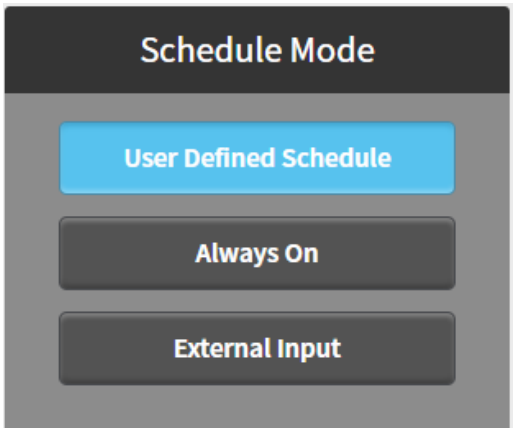


Figure 42 - Plant Schedule

5.9.1 User Defined Schedule Mode

When `User Defined Schedule` is selected, a Calendar panel appears with three tabs - `Weekly Schedule`, `Special Events` and `Summary`.

5.9.2 Weekly Schedule

When Weekly Schedule is selected, a weekly calendar appears. Users can specify the time range in which the plant is enabled or disabled. To specify a time range, simply move the mouse cursor on the start time and drag to the finish time, and hit `Save button`. For example, a time range from 9:00 AM to 6:00 PM on Monday is specified below.

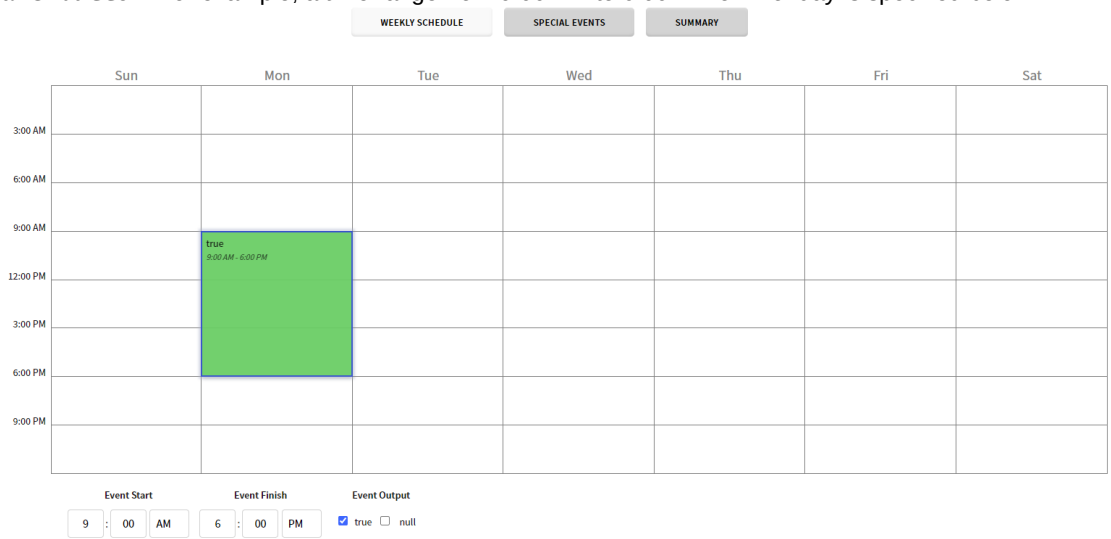


Figure 43 - Plant Weekly Schedule

To modify a created time range, select the time range and change Event Start and Finish time or change Event Output, and **hit the** `Save button.`

5.9.3 Special Events

Special events can be created in `Special Events` tab. To add a special event, click the Add button ⊕. In the pop-up window, specify Display Name, Type and Time.
For example, 1st January is a public holiday in which a plant is disabled. A special event is created for this day. Display Name is New Year Day, Type is Date and Data is 1st Jan Any Year as shown below,

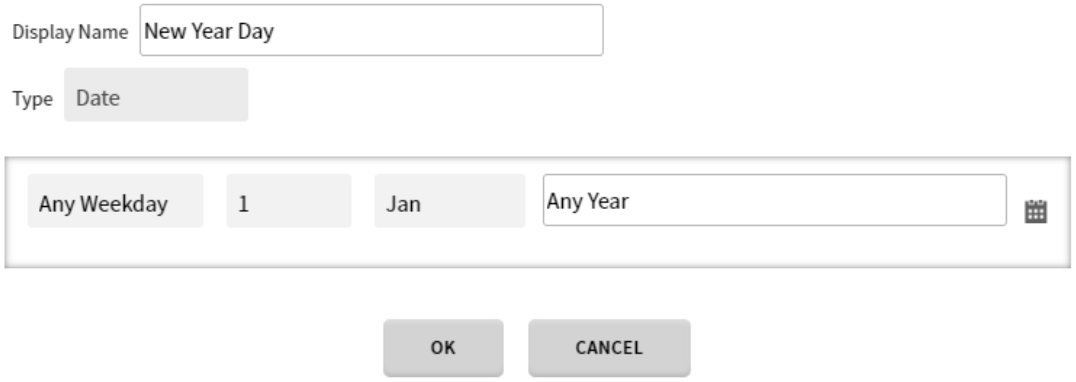


Figure 44 - Schedule Special Events

Press OK button to confirm the date. Then move the mouse cursor on the desired start time and drag to the finish time and set Event Output, and hit Save button. On 1st Jan, the plant is disabled from 12:00AM to 12:00PM as the setting shown below.

5.9.4 Schedule Summary

When Summary tab is selected, a summary calendar appears. Clicking on a particular date will show the schedule on this date. An example is shown below.

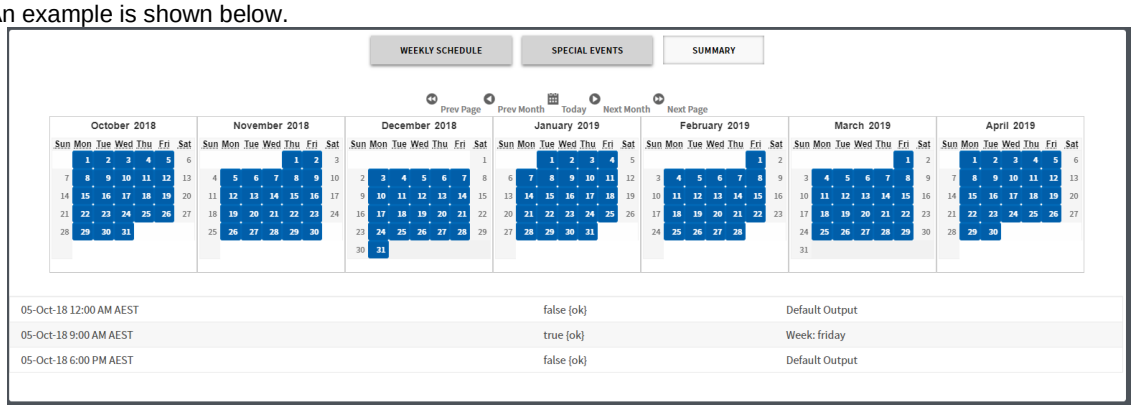


Figure 45 – Schedule Summary

5.9.5 Always On Mode

When Always On mode is selected, the plant is constantly enabled. No Save button is required to hit.

SmartControlSystem is set Always On by default because the start of primary circuit is based on Air Side Call.
Scheduler of the HVAC system must be applied to the Dashboard → Zones →Zone Groups, clicking on scheduler button

5.10 User Management

A user with Config access level can add other user profile to the SmartControlSystem, assigning the User Name, Password and Access Level
Navigate to the User Management page via SmartControlSystem Configuration navigation pane. The screen below should appear.

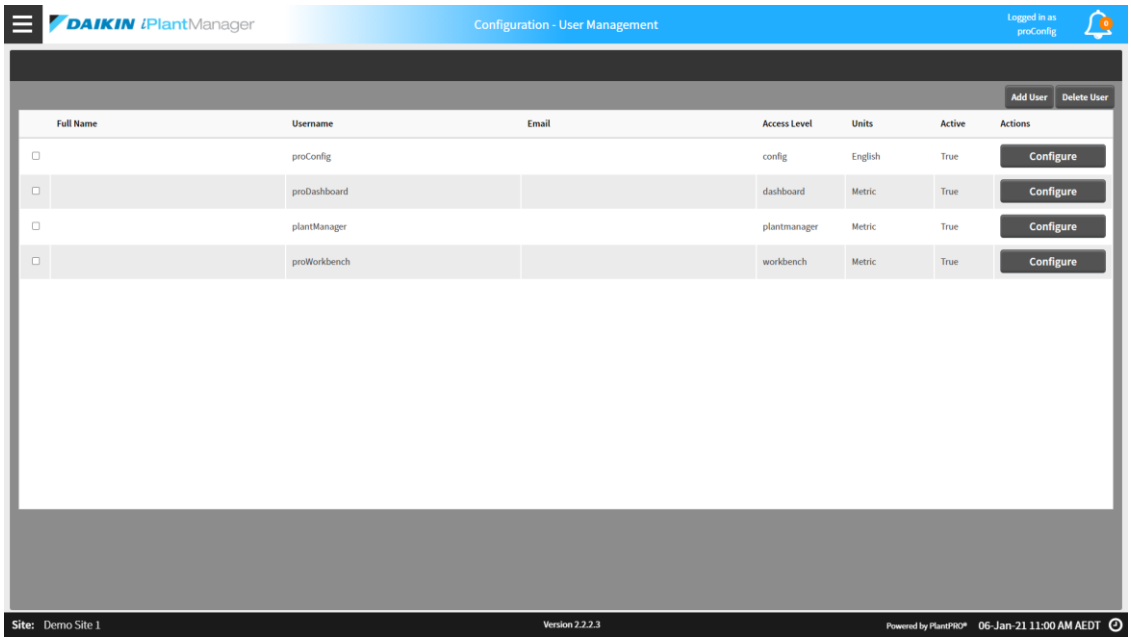


Figure 46 - User Management Settings

To add a new user, select the `Add User` button at the top right corner. The window, as observed below, should appear.

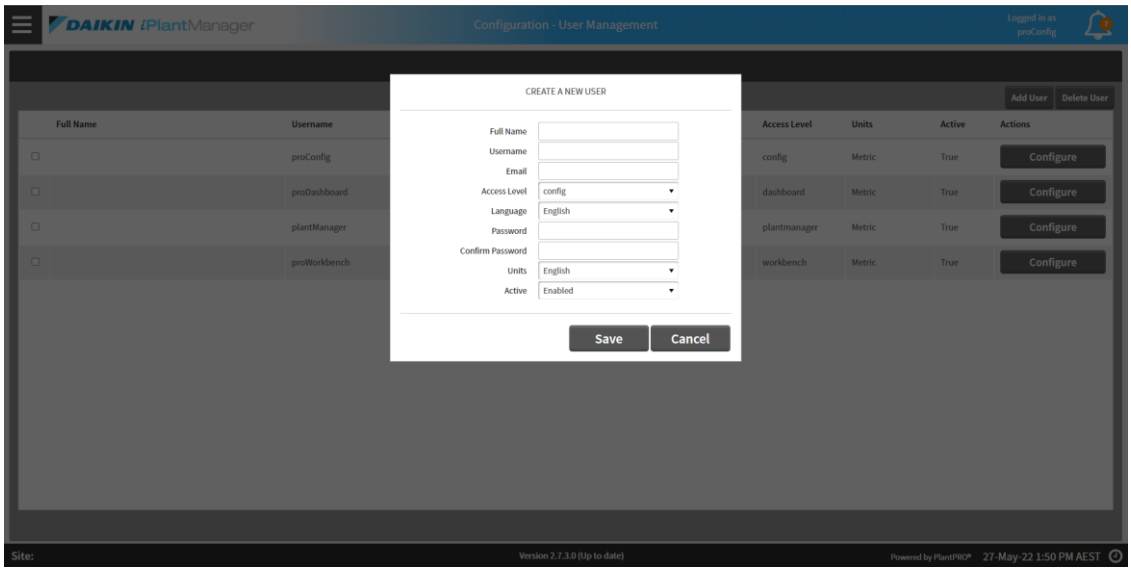


Figure 47 - User Management Wizard

Enter all required information and press the *Save* button to add this user. The added user should now be added to the `User Management` screen as seen below.

When adding/configuring user, user `access level` can be chosen from following three options:

- `config` - Config user can commission a SmartControlSystem project installation, and edit plant design information and control parameters. Config user has full access to the configuration portal and dashboards portal.
- `plantManager` - PlantManager user has access to SmartControlSystem dashboards portal and Plant manager view. On Plant manager view, the plant can be operated manually. Plant Manager user has no access to the configuration portal.
- `dashboard` – Dashboard user is able to monitor the plant operation in SmartControlSystem dashboards portal. Dashboard user has no access to the configuration portal and Plant manager view.

It is highly recommended to provide only PlantManager users and Dashboard Users for the final customer

To alter any settings of an existing user, select the *Configure* button for that user on the right hand side of the screen. A window as observed below should appear.
Once new data and values have been entered, select the *Save* button to save all changes for that user.

If a user or multiple users need to be deleted, users can be selected by selecting the check box next to the required users, Once all required users have been selected, press the `Delete User` button. The window as seen below will appear to confirm the deletion of the selected user
Press OK if this is the user that is required to be deleted. This user will then be removed from User Management list.

5.10.1 Default Users

Name	Authentication Scheme	Nav File	Roles
proConfig	config	file:^nav/configuration.nav	config
proDashboard	dashboard	file:^nav/dashboards.nav	dashboard
plantManager	plantManager	file:^nav/plantmanager.nav	plantManager

5.11 Email Service Configuration and Setting

In the `Email Service Configuration` page, users can configure accounts for the Niagara Email Service
To access this page, select the Email Configuration option under Services in the `Main Menu`.

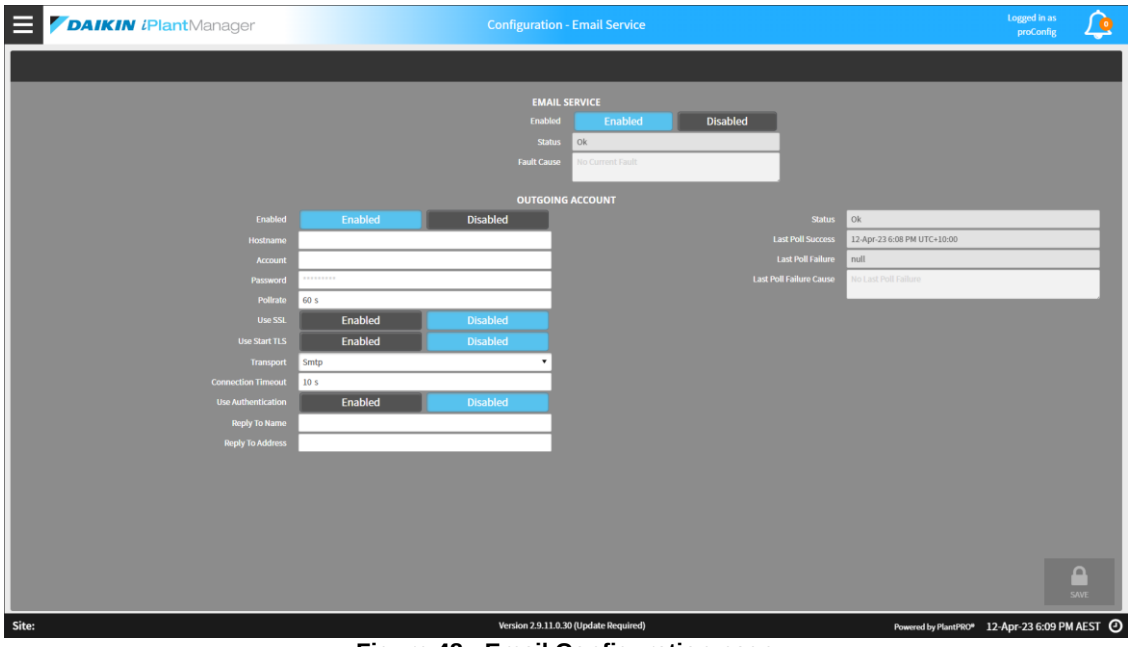


Figure 48 - Email Configuration page

5.11.1 Email Service

The following data can be configured for the Email Service

Parameter Name	Description
`Enabled`	Whether the Email Service is enabled.
`Status`	The current Status of the Email Service.
`Fault Cause`	The latest Fault Cause from the Email Service.

5.11.2 Outgoing Account

The following data can be configured for the Outgoing Account

Parameter Name	Description
`Enabled`	Whether the Outgoing Email Account is enabled.
`Hostname`	The Hostname to use for sending Emails from this Account
`Account`	The account name used for authentication with the Email Service Provider.
`Password`	The password used for authentication with the Email Service Provider.
`Pollrate`	The frequency with which to poll the host
`Use SSL`	Secure Socket Layer for communication with host email server.
`Use Start TLS`	Enable STARTTLS for emails servers that don't support regular SSL/TLS
`Connection Timeout`	The connection timeout when connecting to the email host.
`Use Authentication`	Whether or not the email host requires authentication.

Parameter Name	Description
Reply To Name	This account's reply-to name
Reply To Address	This account's reply-to address
Status	The Status of the Outgoing Email account.
Last Poll Success	The last time a poll was successful.
Last Poll Failure	The last time a poll failed.
Last Poll Failure Cause	The reason that the last poll failed.

5.12 IT Settings

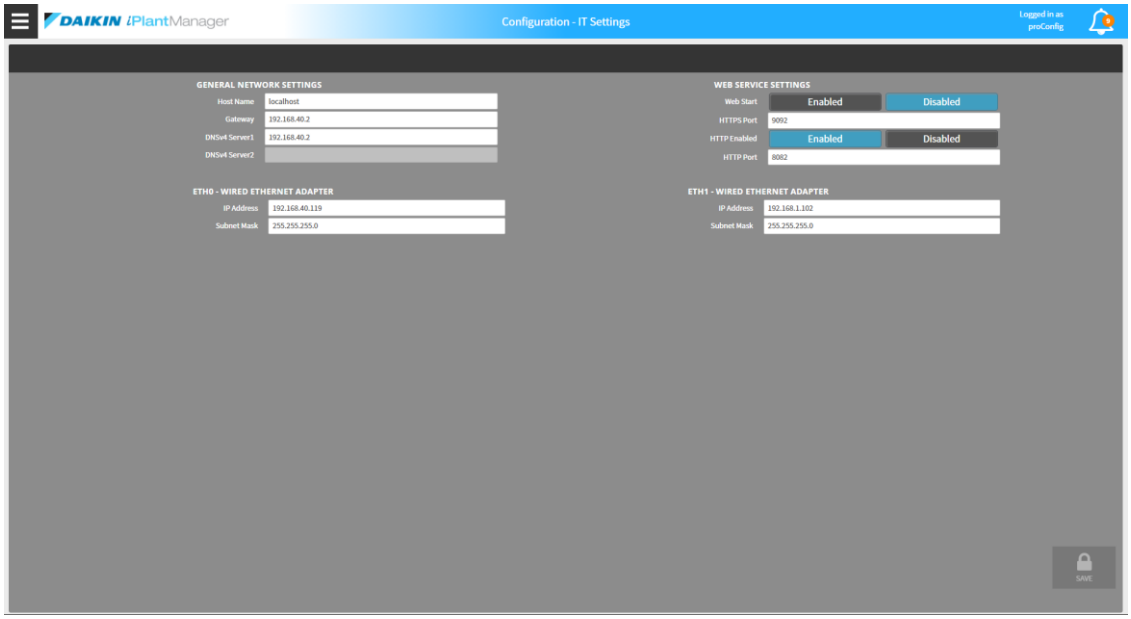


Figure 49 - IT Settings

The SmartControlSystem IT settings page can be accessed by clicking "IT SETTINGS" in the main navigation menu. The following parameters can be configured on this page:

IT Settings Page Parameters	
Parameter	**Description**
Host Name	Define the device host name. This name will be visible to other devices on the IP network
Gateway	Define the IP Gateway, this device is responsible for handling internet traffic. It is likely to be the address of a router
DNSV4 Server1	Define the primary DNS server1. Generally the DNS can be a public DNS or a private DNS server, a public DNS server example is 8.8.8.8
DNSV4 Server2	Define the secondary DNS server2. Generally the DNS can be a public DNS or a private DNS server, a secondary public DNS server example is 8.8.4.4
Web Start	Enable or disable allowing users to login using the Niagara Web Launcher.
HTTPS Port	Define the web port on which the user interface can be reached when using HTTPS (SSL). Note, on the CI-534 hardware the configured port MUST be above 1024.
HTTP Enabled	Define if the user interface can be reached using HTTP. This is not a secure connection.
HTTP Port	Define the web port on which the user interface can be reached when using HTTP. Note, on the CI-534 hardware the configured port MUST be above 1024.
IP Address	Define the IP address of SCS controller. Take caution in setting this address as incorrect configuration can cause the controller to become unreachable on the network
Subnet Mask	Define the IP Subnet for the SCS controller. This is related to the existing network configuration, generally 255.255.255.0 is utilised as a subnet mask. Take caution in setting this address as incorrect configuration can cause the controller to become unreachable on the network.

5.13 License Services

On this page users can review their license and its features, along with the EULA's that have been agreed to.
This page can be viewed from both the Dashboard or the Configuration menus by selecting the `License Service` from the selection of drop downs on the main menu.

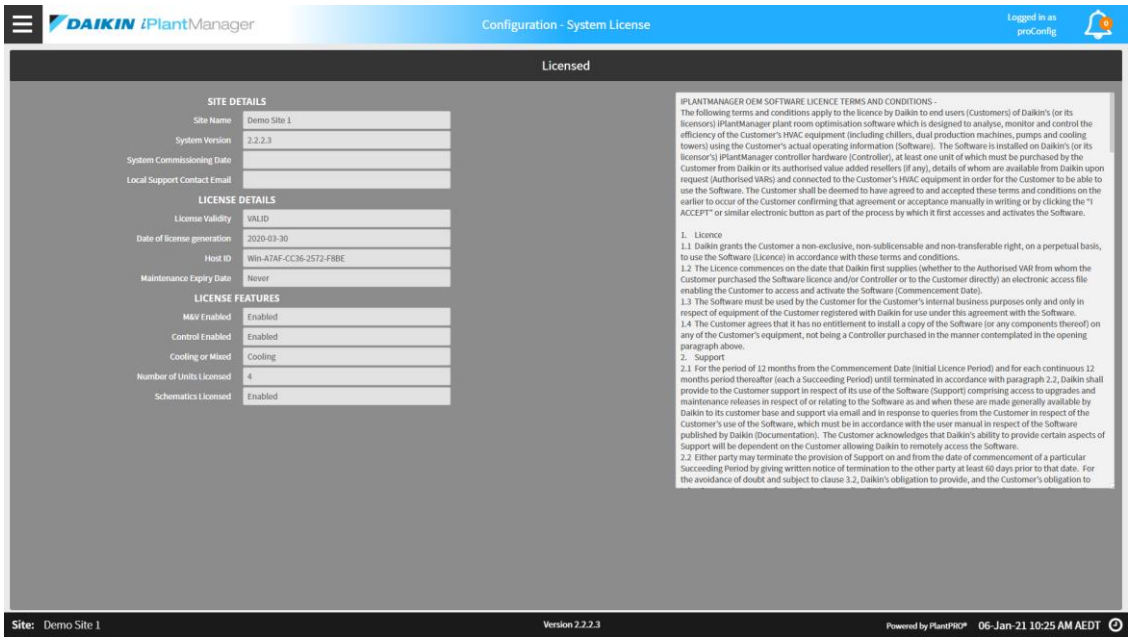


Figure 50 - License Page

While unlicensed, users will automatically be directed to this page if they try to access any other feature. The main menu will also be disabled.

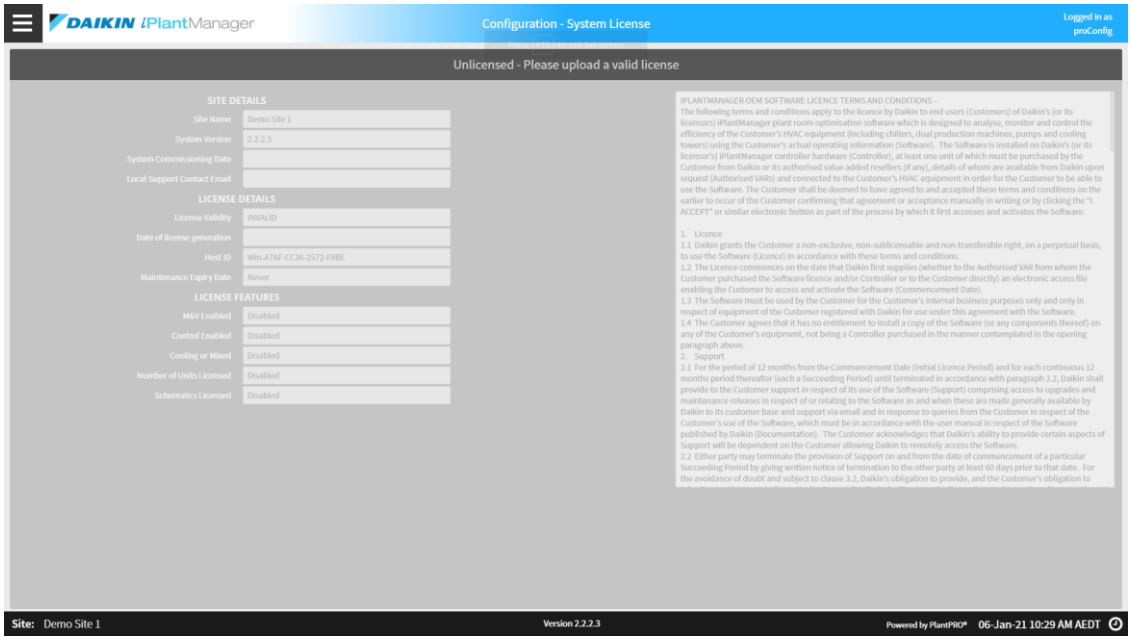


Figure 51 - License Page - Unlicensed Controller

If the controller should be unlicensed please contact Factory

6 USER MANUAL

After logging in to SmartControlSystem interface, a different menu and consequently even different information of the HVAC System will be available according to access level:

- `plantManager` - PlantManager user has access to SmartControlSystem dashboards portal and Plant manager view. On Plant manager view, the plant can be operated manually. PlantManager user has no access to the configuration portal
- `dashboard` – Dashboard user is able to monitor the plant operation in SmartControlSystem dashboards portal. Dashboard user has no access to the configuration portal and Plant manager view.

6.1 Overview page

Upon logging in with a `dashboard` user, the SmartControlSystem `Overview` page will be accessed.
The SmartControlSystem Overview includes a series of data widgets which provide the user with general information about the immediate state of the chiller plant.

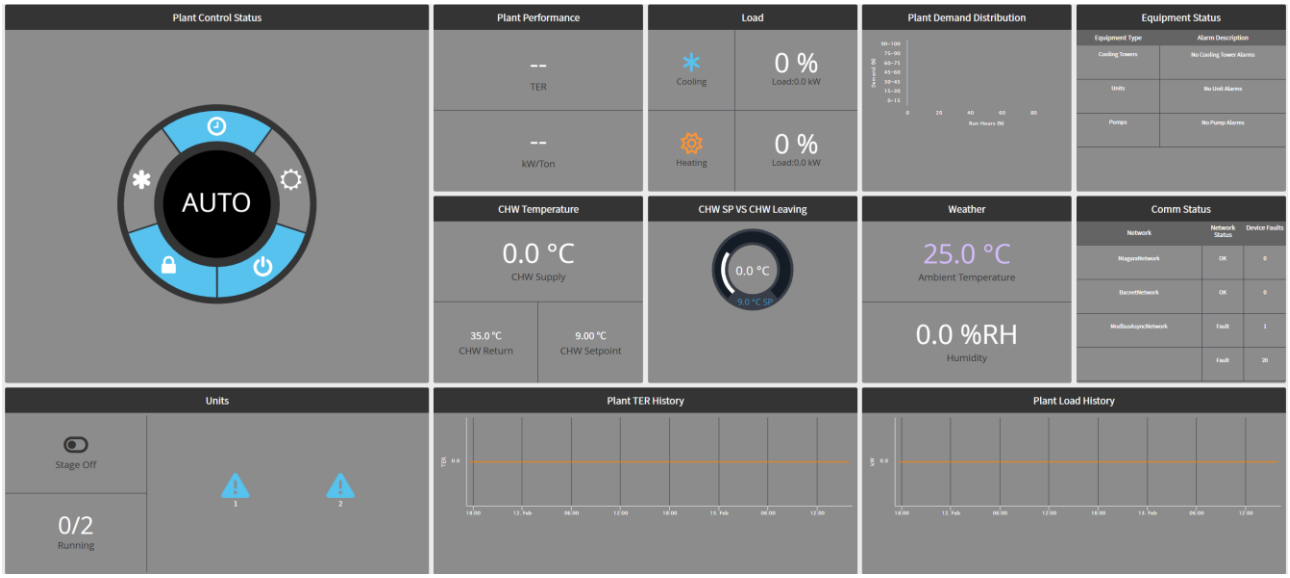


Figure 52 - Overview Page

6.1.1 Plant Control Status Widget

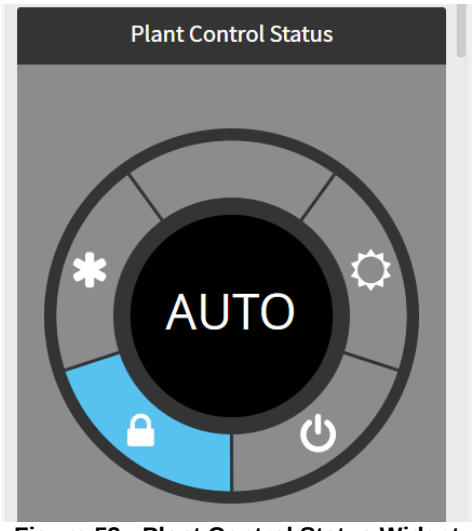


Figure 53 - Plant Control Status Widget

On the panel on the left-hand side, at the top, the control states are displayed:

- The **snowflake** icon shows whether a Cooling Call is present
- The **lock** icon shows whether plant is available to run or locked out based on ambient temperature lock out
  The **power** icon shows whether there is an external Plant Enable signal
- The **sun** icon shows whether a Heating Call is present

6.1.2 Plant Performance

Plant Performance Widget displays the instantaneous full plant COP and plant kW/Ton.
This COP or kW/Ton indicates the level of efficiency present within the plant room - a higher COP indicates a more efficient plant and a lower kW/Ton indicates a more efficient plant.

6.1.3 Plant Load

The load data widget displays the instantaneous cooling/heating load in percentage, current load and full plant capacity.
Total plant load is a calculation of the current load over the full plant capacity. This total load percentage is not current load of active chillers.
Current plant load is shown in either kW.
Full plant capacity is the total capacity of the plant including all chillers configured within SmartControlSystem , this is displayed in either kW.

6.1.4 Plant Demand Distribution

The Plant Demand Distribution widget informs the users of the percentage of time that the chiller plant operates within each demand region.
This chart can help to visualise and understand the normal range of operation of the plant.
By hovering over each region with a mouse, a pop-up will be shown to indicate the actual run hour percentage for the chosen region.

6.1.5 Units

The Units Data widget allows the user to quickly see how many units are running, which units are running and what state the current staging state is.
The staging state is shown in the top left corner of the data widget.
This will display one of the following states:

- Stage up Cooling/Heating - all conditions are present for a staging up event, currently waiting out stage up timer
- Stage down Cooling/Heating - all conditions are present for a staging down event, currently waiting stag down timer
- Stage normal - no staging up or down events currently in process, plant conditions are currently stable

The bottom left shows numerically how many units are running.
The right portion of the data widget shows graphically which chillers or heat-pump units are running. For chillers it will be displayed in blue colour, for heat-pump units it will be displayed in yellow colour. It will also have the unit identification numbers.

Icon	State
	Unit Running
	Unit Available
	Unit Standby
	Unit Offline
	Unit Unavailable
	Unit Induced Offline
	Unit Manual Offline

Table 16 - Unit Icons

6.1.6 CHW / HW Temperature

The CHW Temperature data widget displays the instantaneous chilled/hot water supply and return temperature as measured at the plant headers. This is not the individual unit water supply and return temperature, rather the temperature at the plant level.
The temperatures are shown in either °C.

According to the SmartControlSystem and HVAC system operating mode (Cooling or Heating) the specific data will be displayed.

6.1.7 Weather

The `weather` widget displays the current ambient conditions as average of the temperature sensor read by Daikin Units. Out side air humidity will not be available unless the SmartControlSystem Controller will not be connected to internet to a weather station

6.1.8 Communication Status

The `communication status` widget displays all communication networks that are presently configured within SmartControlSystem .
The status column will inform the user of the network status, while the faults column will inform the user of the number of current device faults.

6.1.9 Equipment Status

The `Equipment Status` widget displays any current equipment faults. If a fault is present on any equipment the text will change to 'ALARM' and the line will be highlighted in orange. The 'Alarm Description' field will display the number of 'unable to run' alarms present for each equipment category.

6.1.10 Plant COP History

The `Plant COP History` widget displays the efficiency history over the past 24 hours.
The data widget will continue to update automatically over time.
The efficiency is shown in either COP for SI.
Note that for heating capable systems COP is replaced with TER (Total Efficiency Ratio) which is the same calculation as COP but calculates load as the total of heating & cooling load.

6.1.11 Plant Load History

The Plant Load History widget displays the total plant cooling load over the past 24 hours.
The data widget will continue to update automatically over time.
The cooling load will be displayed in kW or tR for SI and US users accordingly.

6.2 PlantManager Navigation Panel

Upon logging in as `plantManager` access level, user can navigate around the SmartControlSystem screen. The navigation menu will appear from the left side of the screen by clicking the menu icon in the top right of dashboard portal. Desktop users will have access to all SmartControlSystem dashboard screens and functions.

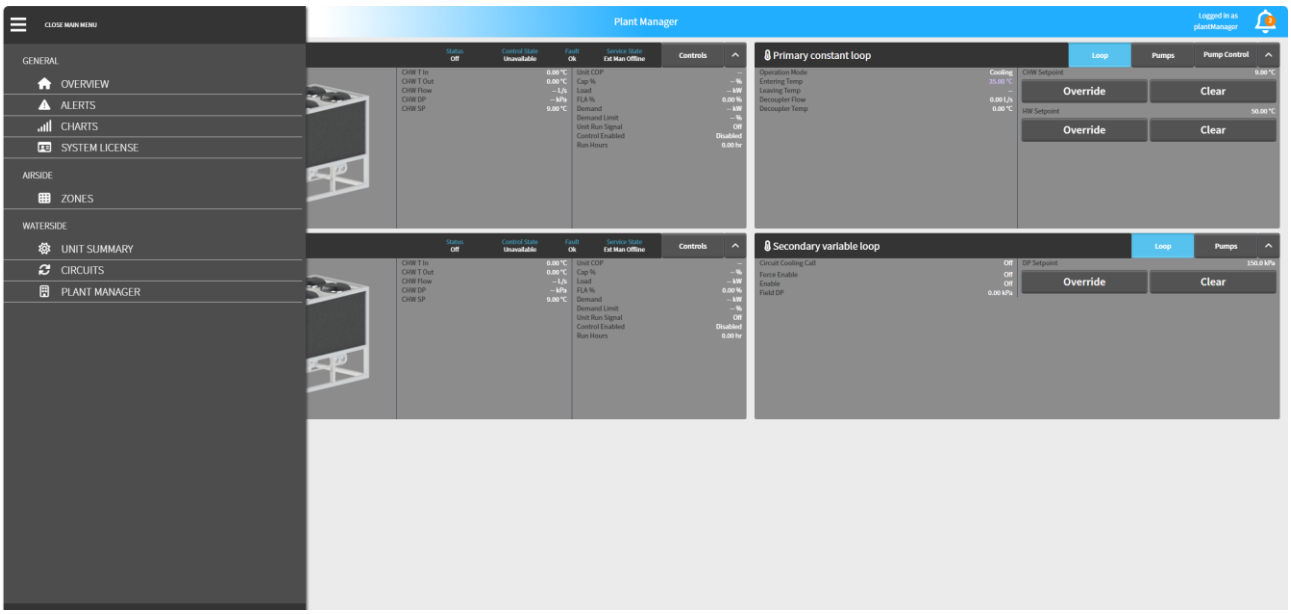


Figure 54 - PlantManager Main Menu

Within the menu, the user can select to visit the following screens:

- `Overview`
- `Alerts`
- `Charts`
- `System License`

- Airside
    - Zones
- Waterside
    - Unit Summary
    - Circuits Summary
    - Plant Manager

The user can close the main menu and return to the current screen by pressing close main menu at the top of the navigation menu.
The user can also choose to log out of SmartControlSystem by clicking the logout button.

6.3 Alerts Page

The Alerts screen provides an in-depth look of all the alerts including alarms, faults, and analytics in the system. To navigate to this view, click on the Alerts tab from the main menu or just simple click on the alarm bell icon on the top right corner of the header of the page.
Notes:

1. By default, when first visiting the page, only the Fault of All equipment for the **last hour** will be shown on the alert table.
2. Users can query alerts based on Equipment type, Alert type and timestamps using the Filter pane on the left hand side.

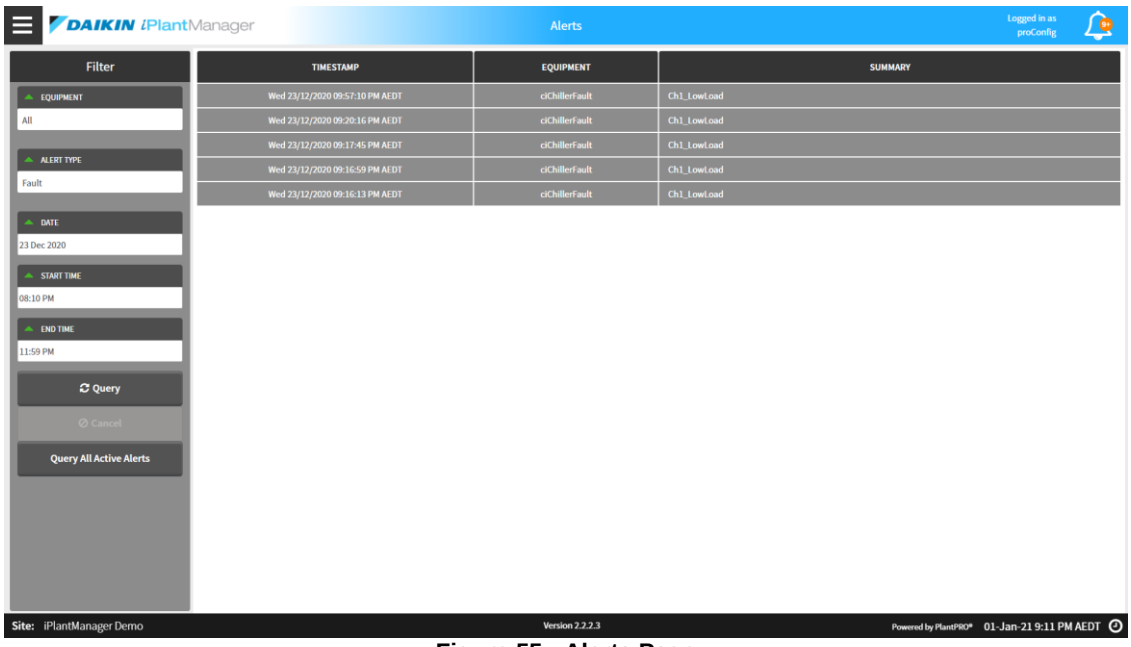


Figure 55 - Alerts Page

The user can click on a particular fault or alarm to receive additional information.

6.3.1.1 Alarm vs Fault

Alarms and Faults can be filtered out using the Alert type tab, also the alarms are highlighted in Yellow, while the faults will be highlighted in Orange instead. The timestamps format will be converted automatically and shown in either dd/mm/yyyyy (UK) or mm/dd/yyyy (US) depending on the current user login

6.3.2 Filter

By default, when first navigating to this page, the filter will be set for **all equipment** (including chiller and compressor alerts), and for fault **type only**. Also, the time range will be set for the last hour of the current day.
To filter alerts by alert types, simple select the options from dropdowns. Alert type could be All, Fault, or Alarm.
Equipment type will filter out alerts for chiller or for each individual compressor. There is a figure right next to each equipment indicating the total number of active Alarms and Faults for that equipment.
Users can also use calendar to select the start date and end date, start time and end time could be set easily by corresponding tab on the filter.
The Query button will be flashing when there is a new alert just arriving while on this view. When clicked, this button will be greyed out and the alert table will be updated accordingly. In addition, the Cancel button could be used to cancel the querying while the job is in progress.
To view detail on each individual alert, simply click on the alert row, the message detailing the cause of the alert will be shown.

6.3.3 Sorting

Alerts can be sorted in a certain order by Timestamp, Equipment, or Summary. To do this, click on the header of the alert table. For instance, to sort by equipment type, click on "Equipment" header of the second column, the content will be sorted by alphabetical order. By default, when first visiting this view, the table will be sorted by Timestamp in descending order, which shows the most recent alert at the top.

6.3.4 Active Alerts

By selecting the `All Active Alerts` button as highlighted in red below, all active alerts will be queried and appear in a pop-up window.

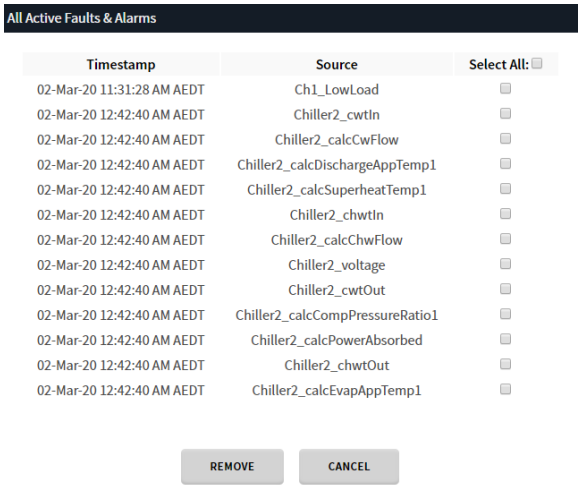


Figure 56 - All Active Faults & Alarms

This pop up can be observed above. For only advanced users, active alerts can be removed by selecting the corresponding `Remove` box and pressing OK. These alarms will then be removed.

6.4 Charts Page

The `Charts` page provides all recorded historical data for all devices such as chillers, pumps, cooling towers, etc.

Figure 57 - Charts Page

The charts page is not available to tablet or mobile users.

6.4.1 Charting

Adding data points

The page is divided into two sections: chart select and charting area. The select tab on the left can be used to select data to plot on the right-hand side space. A maximum of four charts, with four data points is able to be plotted at a time. A

warning will pop up if more than four charts, of four data points per chart, are selected. To select the points, use the drill-down menu in the Points to create a new chart select the data point on the left-hand side. To add a data-point to an existing chart, select and drag the data point to add and drop it on the chart to add it to. Once selected, the point will be underlined and highlighted.
Once plotted, the currently examined value of the point will be displayed on the right-hand side of the chart. The detailed information of the point including the exact value and time is shown in a square box on the chart with a little dot highlighted. When users select different points on the chart, this detailed box will dynamically move along to show the value and time at any specific instance. For the sake of better visibility, different colors are used for plotting each data point. The title will also clearly mark which data point is being plotted.
To set the time range for charting:

- Use the drop-down menu in the Time Range. By default, when first loading this page, the time range will be set to Today.

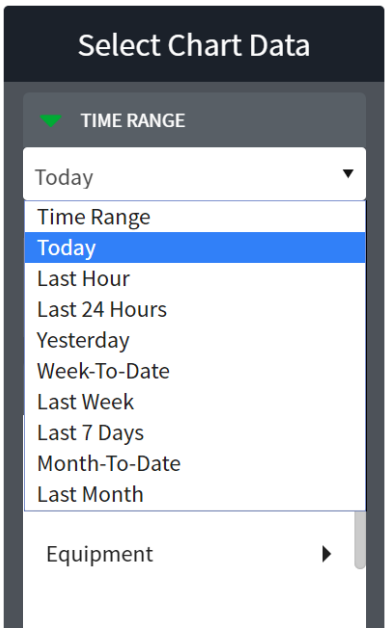


Figure 58 - Chart Selection pane

- To select a custom time range, select Time Range, and press the clock icon below the drop-down menu. A pop-up will appear where the start date/time and end date/time can be configured.
-

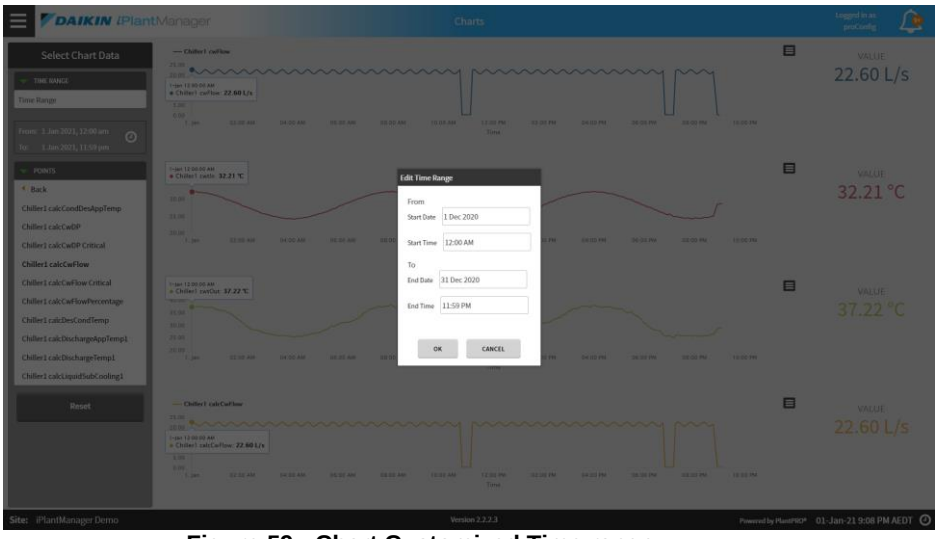


Figure 59 - Chart Customized Time range

Removing data points

To remove a single data point simply click on the data point in the left-hand side or click the name of the data point in the title of the chart. To remove all charts and data points, simply click on the Reset button at the bottom of the left-hand side of the data select section.

6.4.2 Chart Exporting

The chart can be exported to .png or .csv files by clicking on a little button on the top right corner of the chart. A corresponding file will be saved to a local computer or external hard drive.

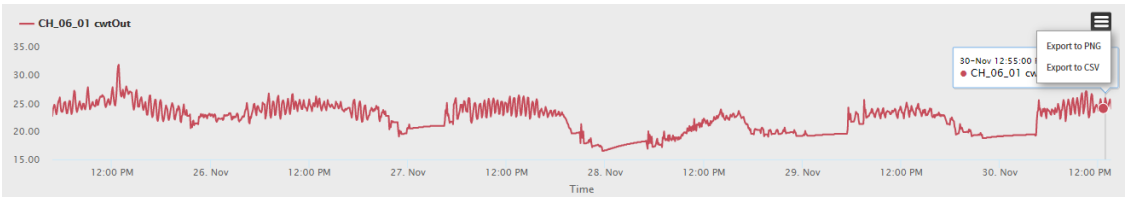
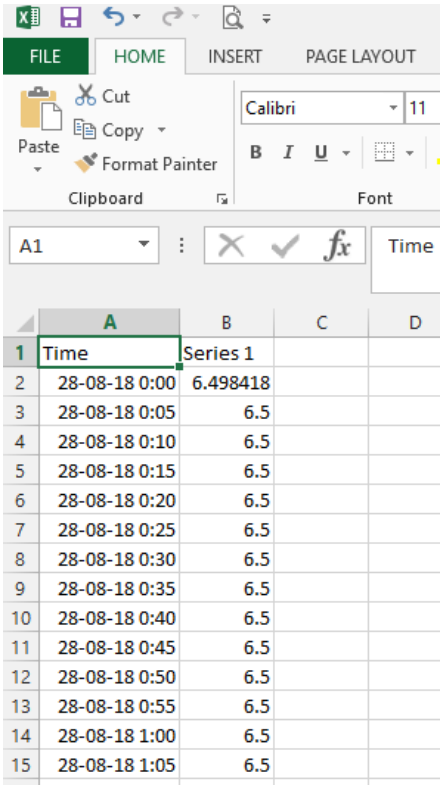


Figure 60 - Chart Export Button



	A	B	C	D
1	Time	Series 1		
2	28-08-18 0:00	6.498418		
3	28-08-18 0:05	6.5		
4	28-08-18 0:10	6.5		
5	28-08-18 0:15	6.5		
6	28-08-18 0:20	6.5		
7	28-08-18 0:25	6.5		
8	28-08-18 0:30	6.5		
9	28-08-18 0:35	6.5		
10	28-08-18 0:40	6.5		
11	28-08-18 0:45	6.5		
12	28-08-18 0:50	6.5		
13	28-08-18 0:55	6.5		
14	28-08-18 1:00	6.5		
15	28-08-18 1:05	6.5		

Figure 61 - Cart Export File .csv

6.5 Unit Summary

In the Unit Summary page, users can view summary data of heat pumps and reversible air heat pumps.
To access this page, select the Unit Summary option under `Dashboards->Waterside` in the Main Menu.

Figure 62 - Unit Summary

The following datapoints are represented at header section of Unit Summary.

Data	Description	Unit
Unit Information Widgets		
`Service State`	Service state displays the current state of the machine.	The states include: Available Running Unavailable Fault - In fault or alarm
`TER`	Total Efficiency Ratio to measure the efficiency of the unit. The total energy produced for both heating and chilling for each kW of electrical energy used by the unit.	
`Status`	Displays the current operating mode of the machine	This status includes: Off, Fault, Cooling, Heating
`FLA%`	Display the instantaneous Full Load Amps (FLA), current used to provide the rated output as a percentage.	%
Unit General Information		
`Total Run Hours`	Display the total run hours of the machine as tracked by	Hours
`Amps`	Displays instantaneous current draw of selected chiller. Current shown is total current, including current from all individual compressors.	Amps
`Volts`	Displays instantaneous three phase voltage.	Volts
`Power Factor`	Displays instantaneous power factor.	

Data	Description	Unit
Demand	Displays instantaneous electrical demand of chiller. Demand shows total demand, including demand from all individual compressors.	kW
Cooling Load	Displays instantaneous calculated cooling load of selected unit. Cooling load calculated based on chilled water temperatures and cooling vessel flow rate.	kW
Cooling Setpoint	Temperature at which the unit will maintain in cooling production.	°C
Heating Load	Displays instantaneous calculated heating load of selected unit. Heating load calculated based on hot water temperatures and heating vessel flow rate.	kW
Heating Setpoint	Temperature at which the unit will maintain in heating production.	°C
Production Vessel (Evaporator) Information		
Temp In	Displays instantaneous fluid temperature measured at the inlet of the vessel.	°C
Temp Out	Displays instantaneous fluid temperature measured at the outlet of the vessel.	°C
Flow	Displays instantaneous calculated fluid flow rate through the vessel.	L/s
DP	Displays instantaneous calculated fluid differential pressure across the vessel.	kPa
Refrigerant Temp	Displays instantaneous refrigerant temperature in the vessel.	°C
Refrigerant Pres	Displays instantaneous refrigerant pressure in the vessel.	kPa
Approach Temp	Displays instantaneous refrigerant approach temperature in the vessel. The approach temperature is calculated from the difference of the fluid leaving temperature & the temperature of refrigerant in the vessel	Δ°C
Saturated Temp	Displays instantaneous refrigerant saturated temperature in the vessel. This is the temperature at which refrigerant will transition from a gas to liquid state.	°C
Source/Sink (Condenser) Information		
Air Temp	Displays instantaneous outside air temperature. This could be measured by the unit or externally depending on the sensor available.	°C
Refrigerant Temp	Displays instantaneous refrigerant temperature in the vessel.	°C
Refrigerant Pres	Displays instantaneous refrigerant pressure in the vessel.	kPa
Approach Temp	Displays instantaneous refrigerant approach temperature in the vessel. The approach temperature is calculated from the difference of the fluid leaving temperature & the temperature of refrigerant in the vessel	Δ°C
Saturated Temp	Displays instantaneous refrigerant saturated temperature in the vessel. This is the temperature at which refrigerant will transition from a gas to liquid state.	°C

Table 17 - Unit Data

To access `Circuit/Design Data`, press the information icon located to the left of the unit display name.

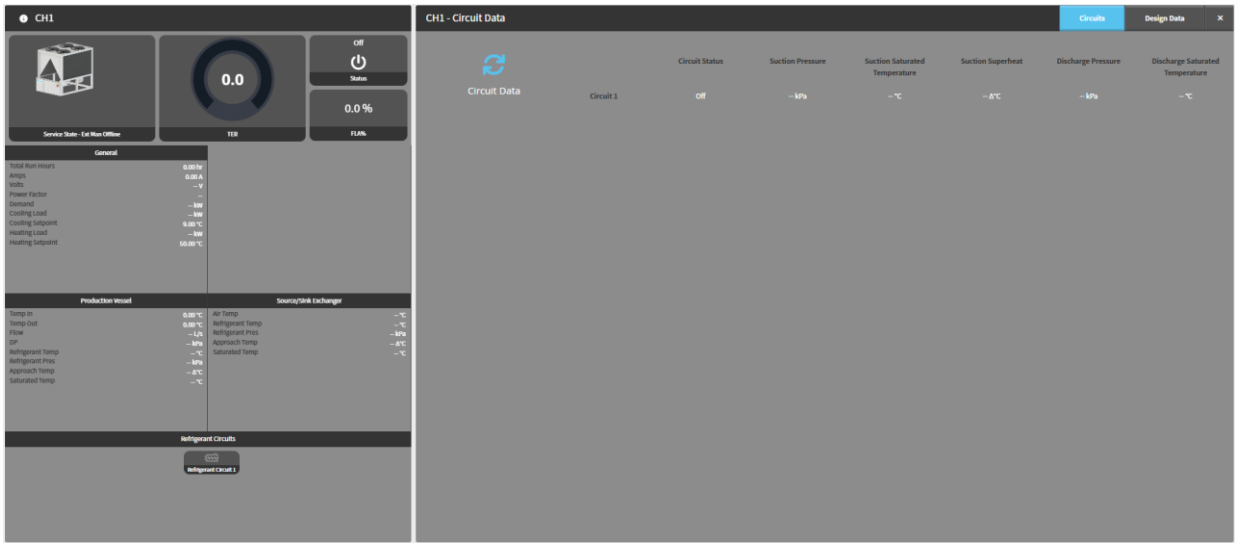


Figure 63 - Unit Circuit Summary

The data within the circuits is as follows:

Data	Description	Unit
`Circuit Status`	Displays the current operating mode of the circuit	This circuit status includes: Running & Off states
`Suction Pressure`	Refrigerant Pressure at the inlet of the compressor	kPa
`Suction Saturated Temperature`	The constant boiling/condensing temperature of refrigerant in the evaporator, determined by suction pressure and refrigerant-specific saturated tables.	°C
`Suction Superheat`	The temperature difference between the actual suction temperature and the suction saturated temperature of the refrigerant in the evaporator.	Δ°C
`Discharge Pressure`	Refrigerant Pressure at the outlet of the compressor	kPa
`Discharge Saturated Temperature`	The constant condensing temperature of the refrigerant in the condenser, determined by discharge pressure and refrigerant-specific saturated tables.	°C

Table 18- Unit Circuit Data

The data within the design data is as follows:

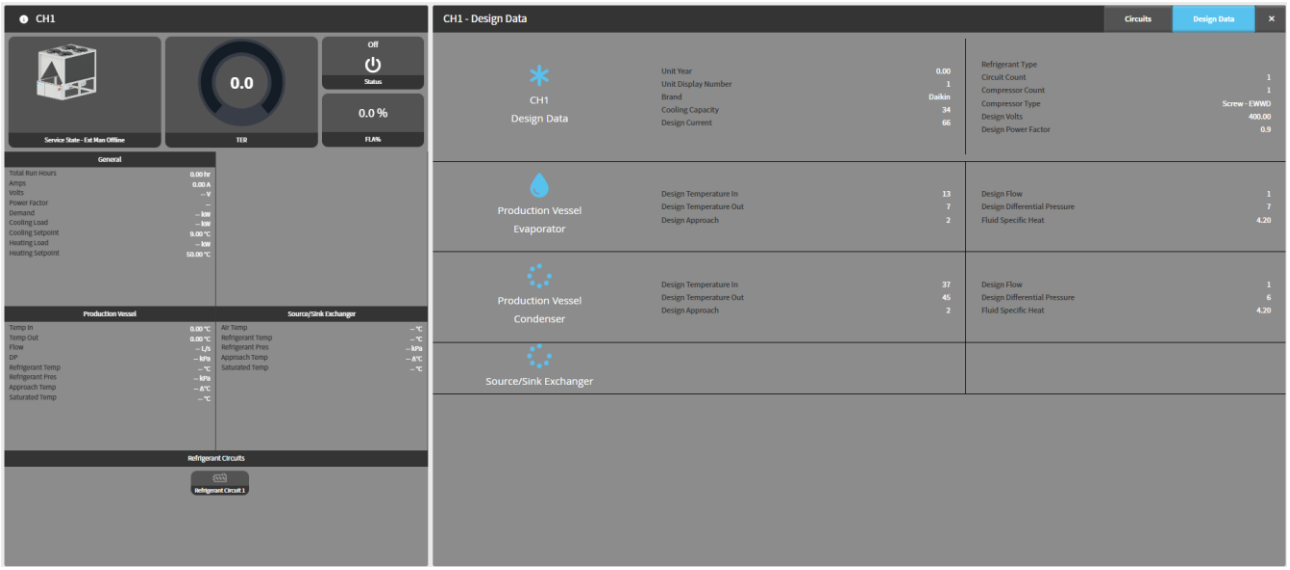


Figure 64 - Unit Circuit Design Data

Data	Description	Unit
Design Data		
Unit Year	The manufacturing year of the unit	
Unit Display Number	The display number of the unit	
Brand	The manufacturer of the unit	
Cooling Capacity	The design cooling capacity the unit is capable of	kW
Design Current	The unit's full load design current	Amps
Refrigerant Type	The refrigerant type used for this unit	
Circuit Count	The number of circuits the unit has	
Compressor Count	The number of compressors the specified circuit has	
Compressor Type	The compressor type used on the unit	
Design Volts	The unit's design voltage	Volts
Design Power Factor	The design power factor of the unit	
Production Vessel / Source, Sink Exchanger		
Design Temperature In	The anticipated temperature of the fluid entering the system during its operation.	°C
Design Temperature Out	The projected temperature of the fluid leaving the system after the heat exchange process has occurred.	°C
Design Approach	The targeted temperature difference between the leaving fluid temperature and the fully saturated refrigerant temperature.	Δ°C
Design Flow	The design full load production fluid flow for the unit	L/s
Design Differential Pressure	The design full load fluid differential pressure	kPa
Fluid Specific Heat	The specific heat of the working fluid flowing through the vessel	kJ/kg°C
Evaporator Design Approach	The evaporator design approach configured within the unit	
Condenser Design Approach	The condenser design approach configured within the unit	

Table 19 - Unit Design Data

6.6 Water Circuits Summary

The water circuit summary page allows the user to observe all water circuit operations in the plant simultaneously. Each water circuit card is applicable to all the pumps within the relevant circuit. It also displays all available and relevant information for this water circuit including water, field, speed and command/feedback information.

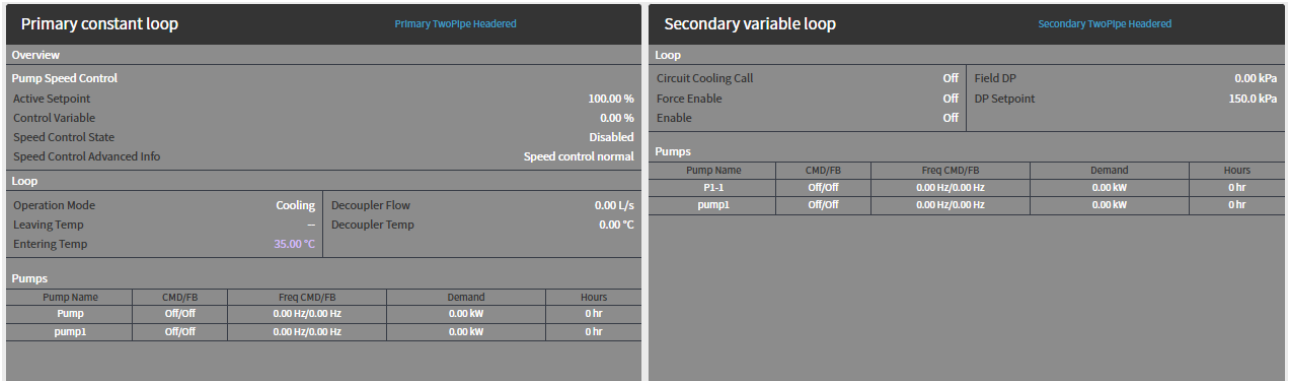


Figure 65 - Water Circuit Summary

6.6.1 Water Circuit Data

The chilled water circuit card displays all relevant information for the chilled water circuit including pump information, chilled water temperatures and field data.

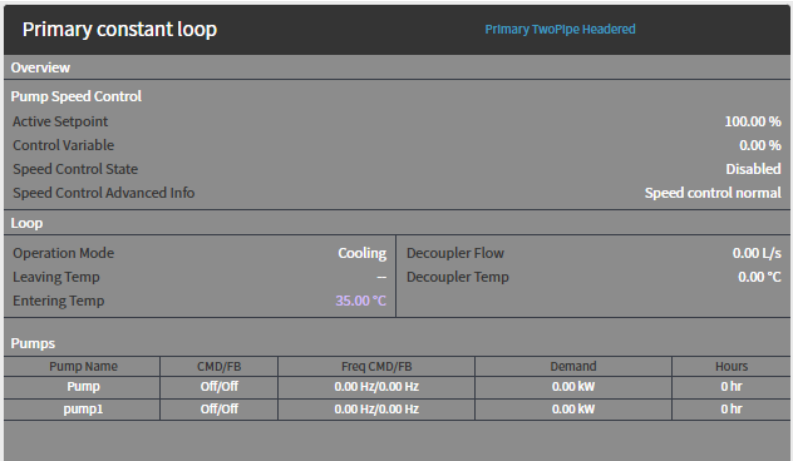


Figure 66 - Water Circuit Data

Data	Description	Unit
Leaving	Displays the supply temperature that the chilled water circuit is pumping to the building.	°C
Entering	Displays the return temperature building is returning to the chilled water circuit.	°C
Temp Setpoint	The temperature set point is the supply temperature that the plant will aim to provide to the building.	°C
Field DP	Displays the differential pressure in the field (external to the plant).	kPa
DP Setpoint	The differential pressure set point is the differential pressure that the plant will aim to reach.	kPa
Bypass Valve	Displays the position of a bypass valve if one is present.	%
CMD/Fb	Displays both the command and feedback of the pump's power status (on/off).	
Freq/Fb	Displays both the command and feedback of the pump's operating speed.	Hz
Demand	Displays the power demand of the associated pump.	kW
Run Hours	Displays the total run time hours of the associated pump.	Hr
Fault	Displays any faults related to the relevant piece of equipment.	

Table 20 - Water Circuit Data

6.7 License Services

Please refer to the Configuration Manual for further details.

6.8 Plant Manager

The PlantManager access level allows a user to view important information for the overall plant as well as providing the user with the ability to override plant operation. This is ideal for situations where the plant's operation has to be altered temporarily, i.e. for maintenance purposes. This page is restricted to Plant Manager and Config users and therefore unavailable to dashboard users.
The main features the Plant Manager provides are:

- Override the operating mode of SmartControlSystem
- Plant level controls such as staging, plant bypass and Temperature setpoint
- Override Chiller service state, Temperature setpoint and demand limit
- Override Pump speed control

The Plant Manager is arranged with plant level information on the left, chiller information in the centre and circuit and related equipment on the right.

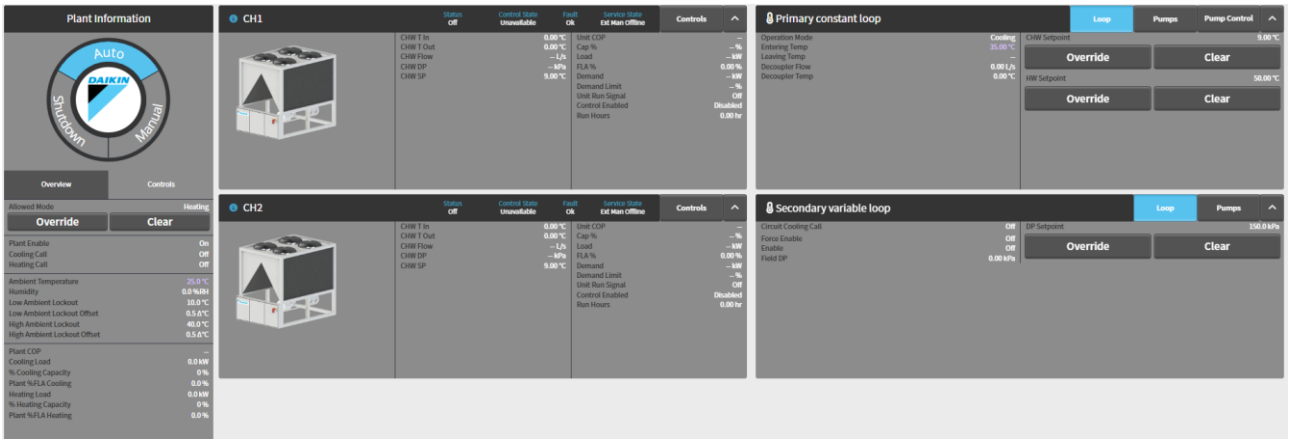


Figure 67 - PlantManager View

6.8.1 Plant Information

The plant information section displays the current plant operating mode, the plant level sensor and calculated data points, and also the plant level override controls under their respective tabs.

Figure 68 - Plant Information Widget - Overview & Control

Data	Description	SI Unit	US Unit
Plant Enable	Enabling of the system by Plant Scheduler		
Cooling Call	Request of Chilled Water by Airside equipment		
Heating Call	Request of Heated Water by Airside equipment		
Ambient Temperature	The ambient temperature of the environment surrounding the building.	°C	°F
Humidity	The humidity of the environment surrounding the building.	%	%
Low Ambient Lockout	The temperature below which the plant will not operate.	°C	°F
Low Ambient Offset	The differential from Low Ambient Lockout that release the plant operation	°dC	°dF
High Ambient Lockout	The temperature above which the plant will not operate.	°C	°F
High Ambient Offset	The differential from High Ambient Lockout that release the plant operation	°dC	°dF
Cooling/Heating Load	Total instantaneous cooling/heating load of the plant. A summation of the cooling load of all running units.	kW	Tons
% Cooling/Heating Capacity	Percentage of load of the running chillers/ Heat Pumps against their design capacity.	%	%
Plant % FLA	Percentage of FLA consumed by the running chillers		

Table 21 - Plant Data and Setpoints

6.8.2 Chiller Information

Information for each chiller will appear as a card in the centre of the plant manager. This card will show

- a graphic representation of the chiller along with
- all the relevant sensors and calculated data points.

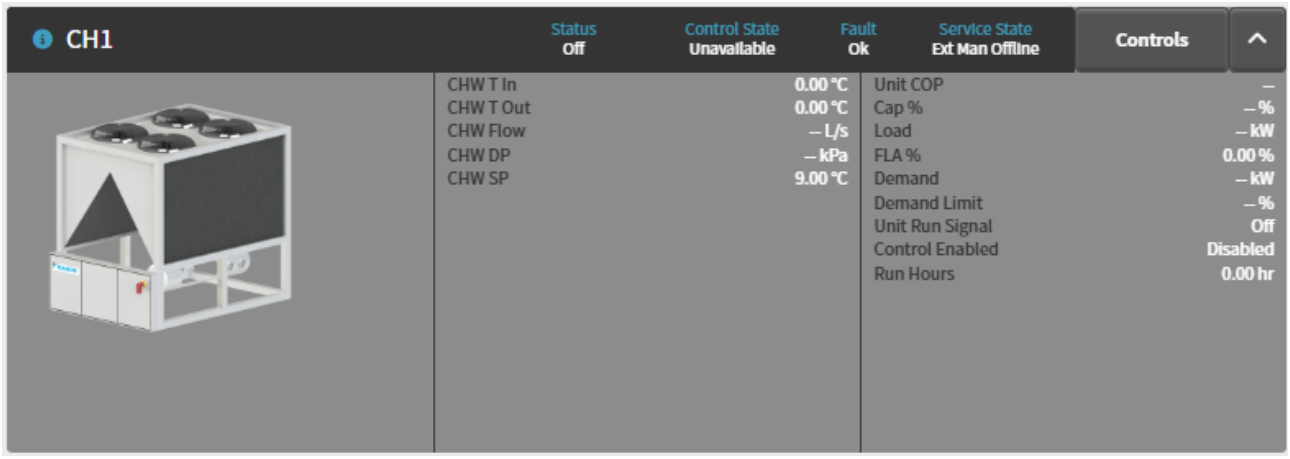


Figure 69 - Unit Widget - Overview

Data	Description	SI Unit	US Unit
Status	Run status feedback from the chiller.	on/off	on/off
Service State	The current service state of the chiller. Possible values: • Available • Standby • Offline • Unavailable • Induced Offline • Manual Offline • External Manual Offline		
Induced Fault	Whether the chiller has an induced fault	ok/ induced fault	ok/ induced fault
Control State	The control state that the chiller controller is in. Possible values: • Chiller start • Chiller stop • Chiller fault • Inducing Flow Fault • Send message to start pump • Send message to stop pump • Waiting for flow • Idle • Unavailable • Chiller Run • Fault Timeout • Pump run on		
Fault	Fault message from the chiller. Possible messages: • Ok • No Evap Flow • Alarm • Comms Fail • Induced Fault		
CHW T In	Instantaneous chilled water return temperature. Temperature is measured at the inlet of the evaporator vessel.	°C	°F
CHW T Out	Instantaneous chilled water supply temperature. Temperature is measured at the outlet of the evaporator vessel.	°C	°F
CHW Flow	Instantaneous evaporator water flow rate.	l/s	gpm
CHW DP	Instantaneous evaporator water differential pressure.	kPa	psi

Data	Description	SI Unit	US Unit
CHW SP	Chilled water supply temperature setpoint.	°C	°F
Thermal Cap %	Instantaneous % cooling load of selected chiller. % cooling load is the percentage of current load against total design load. This parameter is not the traditional %FLA, rather it is a measure relating to the actual cooling being produced.	%	%
Thermal Load	Instantaneous calculated cooling load of selected chiller. Cooling load calculated based on chilled water temperatures and evaporator flow rate.	kW	tons
FLA %	Actual Capacity of the unit in %	%	%
Demand	Instantaneous electrical demand of chiller. Demand shows total demand, including demand from all individual compressors.	kW	kW
Demand Limit	The limit of the chillers electrical demand as a percentage of FLA.	%	%
Chiller run signal	Run signal sent to chiller .	on/off	on/off
Control enable	Whether control has been enabled on this chiller.	enabled/ disabled	enabled/ disabled
Run Hours	The total run ours of this chiller.	hrs	hrs

Table 22 – Unit Data and Setpoints

Override controls are available to the user by pressing the toggle button on the top right corner of the card. Some of these points will only be available to be overridden when the chiller is running or configured to use and are otherwise disabled. The chiller cards are collapsible by clicking the heading.

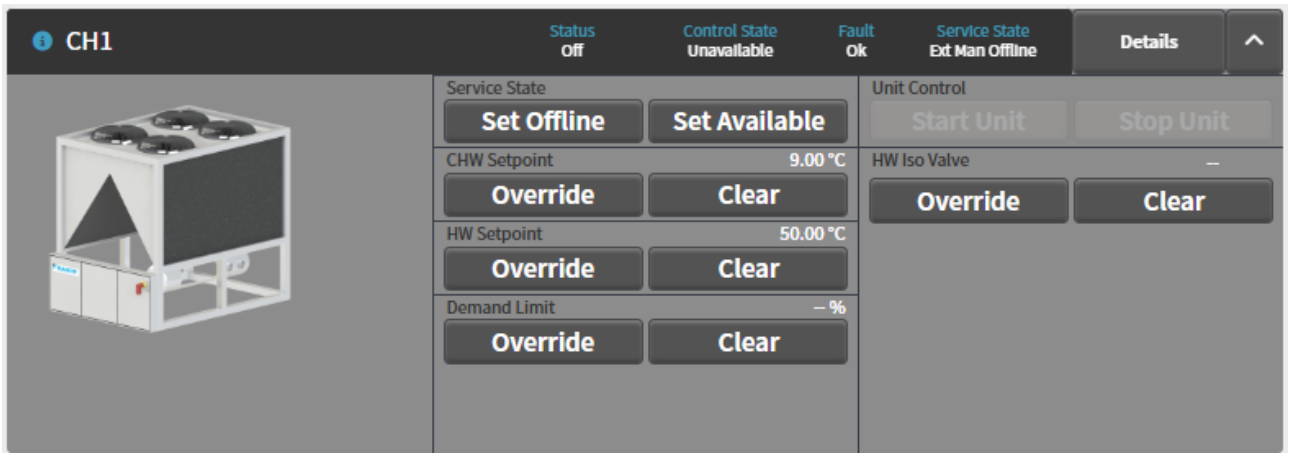


Figure 70 - Unit Widget - Control

In the situation when the Chiller belongs to a set an additional field called "Set" will be displayed to the end-user. This will show which Set the Chiller belongs to and whether is upstream (↑), downstream (↓), or Low Load.

6.8.3 Circuit Information

Information for each circuit along with its related pumps are displayed as a card on the right side of the plant manager. This card will show the relevant loop and pump under their respective tabs. Headered circuits also have a pump control tab.

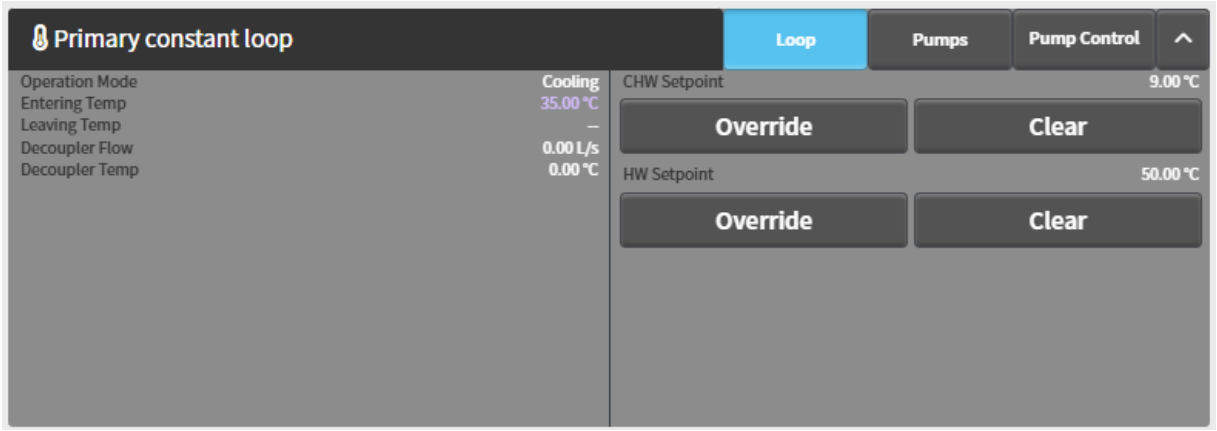


Figure 71 - Circuit Widget – Loop Data & Setpoints

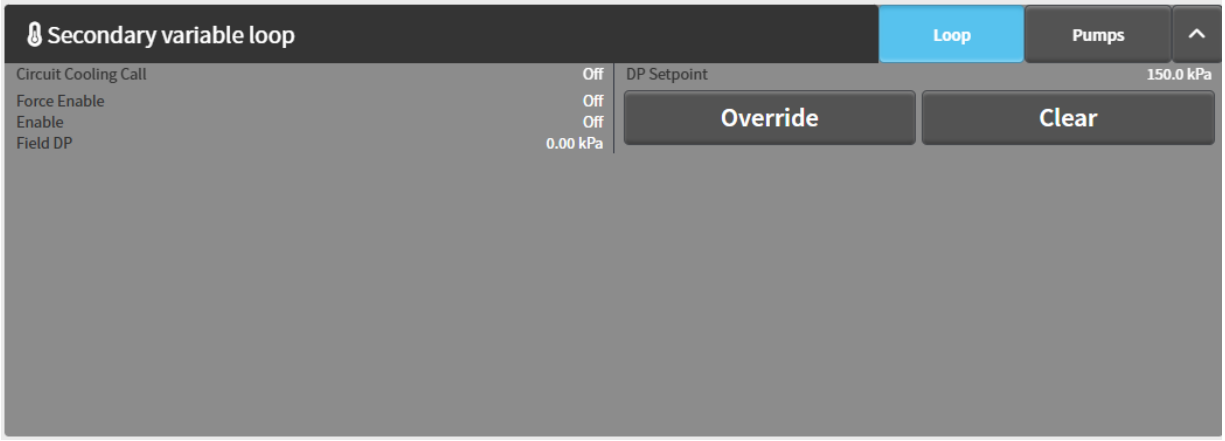


Figure 72 - Circuit Widget - Loop Information & Setpoints

Data	Description	SI Unit	US Unit
Operation Mode	Operation mode of the whole plant Cooling or Heating		
Entering Temp	Instantaneous water return temperature measured at the plant headers or as average of the entering water temperatures of the units.	°C	°F
Leaving Temp	Instantaneous water supply temperature measured at the plant supply header.	°C	°F
Decoupler Flow	The rate of water flow being bypassed through the decoupler line in a primary-secondary system (NOT AVAILABLE).	l/s	gpm
Decoupler Temp	Instantaneous temperature within the decoupler line (NOT AVAILABLE).	°C	°F
CHW SP	Chilled water temperature setpoint the plant will aim to supply.	°C	°F
HW SP	Hot water temperature setpoint the plant will aim to supply.	°C	°F
Circuit Cooling/Heating Call	Request from airside equipment to operate the pump of the circuit		
Enable	Command from SmartControlSystem to operate the circuit device		
Field DP	Plant Differential pressure measured by sensor	kPa	psi
DP setpoint	Setpoint of differential pressure to achieve regulating the speed of the pumps	kPa	psi

Table 23 - Water Circuit Data and Setpoints

When viewing the pumps, the buttons on the left can be used to select the detailed information to be shown on the right. The selection buttons also show the enable command as a tick and its feedback as a green background. Faults will be shown with orange background and a cross.

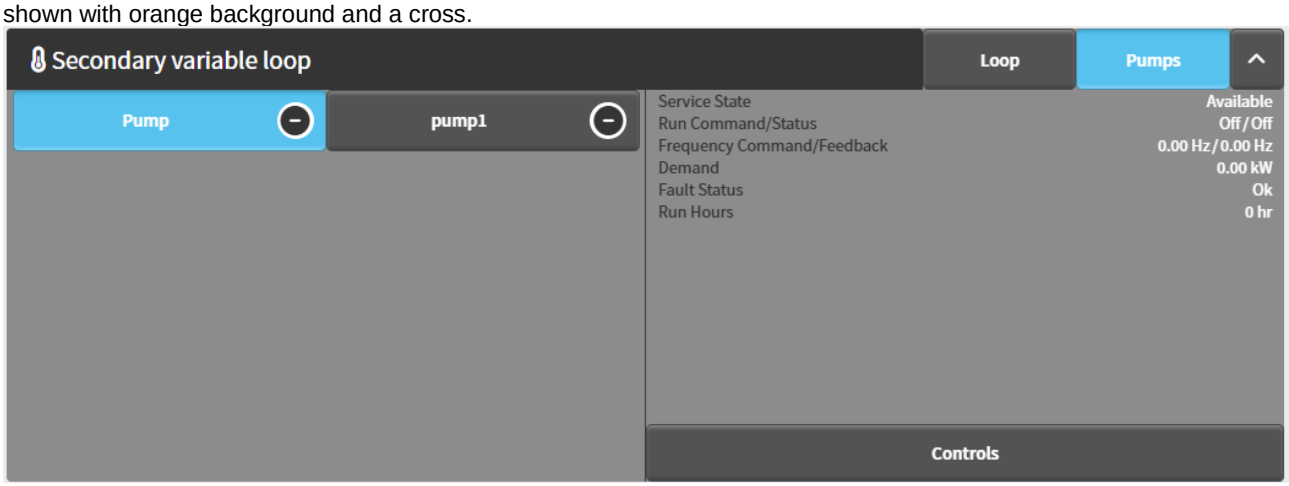


Figure 73 – Pump Widget - Data

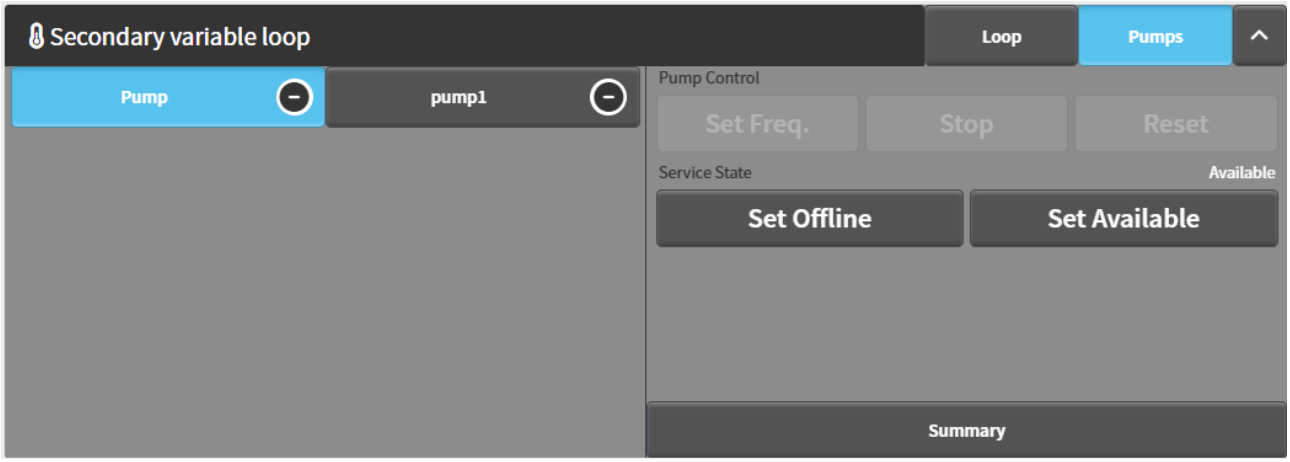


Figure 74 – Pump Widget - Controls

No Fault, no run command	
Run command, false feedback	
Run command, true feedback	
Fault	

Table 24 - Pump Icons

Data	Description	SI Unit	US Unit
Service State	Status of the pump for SmartControlSystem control		
Run Command/ Status	The run enable command and feedback values for the pump.	on/off	on/off
Frequency Command/ Feedback	The frequency command and feedback values for the pump.	Hz	Hz
Demand	The electrical demand of the pump (if available).	kW	kW
Fault Status	The fault status of the pump.	ok/fault	ok/fault
Run Hours	The total run hours for the pump.	hrs	hrs

Table 25 - Pump Data

6.9 Plant Operation Manual

The plant can be set to one of three operating modes from the Plant Manager. These modes are:

- Auto - Plant is under full control by SmartControlSystem . Limited override functionality available
- Manual - Plant will no longer perform automatic staging of chillers and equipment can be manually started and stopped. Chillers will still be run using SmartControlSystem control when manually enabled.
- Shutdown - Plant is shut down completely and no equipment can be started.

The current mode will be highlighted green in the mode dial within the plant information card.

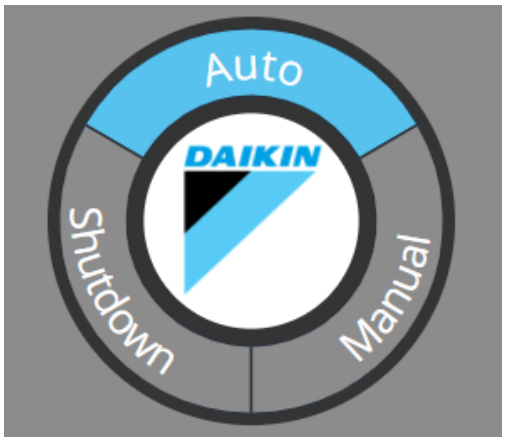
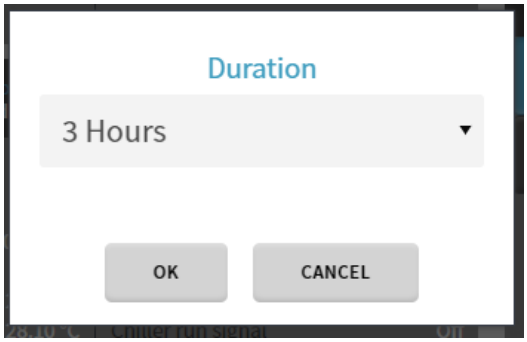


Figure 75 - Mode Selector

6.9.1 Switching Modes

Select a different mode by clicking on it in the mode dial. This will bring up a dialog asking for the override duration. After confirming the override the new mode will be highlighted in the mode dial along with the remaining override duration.



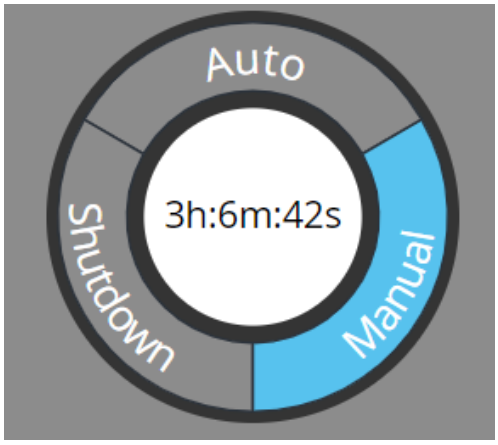


Figure 76 - Overriding the Plant mode

6.9.2 Returning to Auto

Upon expiry of the override or by user input, the plant will be returned to `Auto` mode. Upon switching to auto mode, the plant will shut down and restart to resume full SmartControlSystem control, clearing all overrides except for those available during automatic control. The plant will adhere to all normal shutdown procedures for plant equipment but will ignore the plant shutdown timer.

6.9.3 Override Controls

The Plant Manager allows the user to perform timed overrides on key control points of the plant. To use these overrides, first click the override button for the point. An override dialog would appear to prompt the user to enter the desired override value and duration.

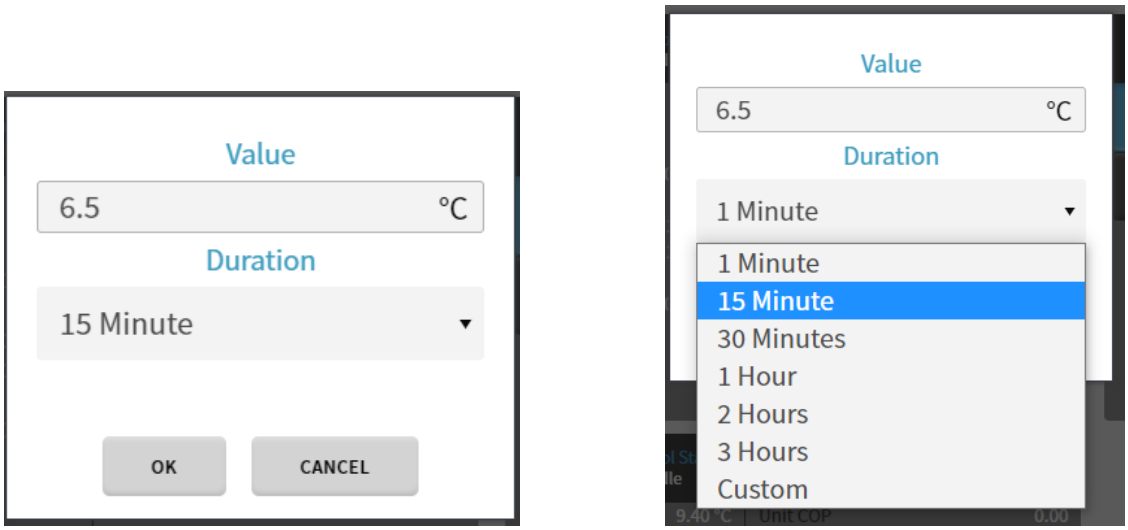


Figure 77 - Override of a Setpoint

For Override points that have limits on them, the lower and upper bounds will be shown in the dialog and will provide a warning to the user if a value outside the limits is entered. When this happens, the user will be prevented from committing the override.

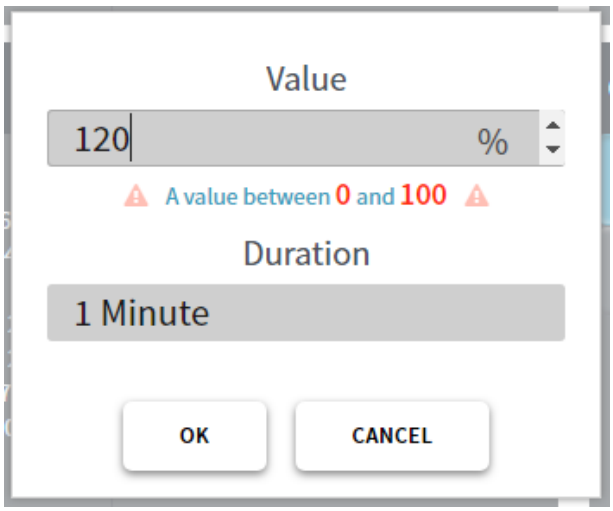


Figure 78 - Limit of overriding

After confirming the override by clicking OK, the override button will show the current time remaining, and the value overridden will be displayed in purple. The button can be clicked again to set a new override or cleared using the clear button.

6.9.4 All Possible Overrides in each mode

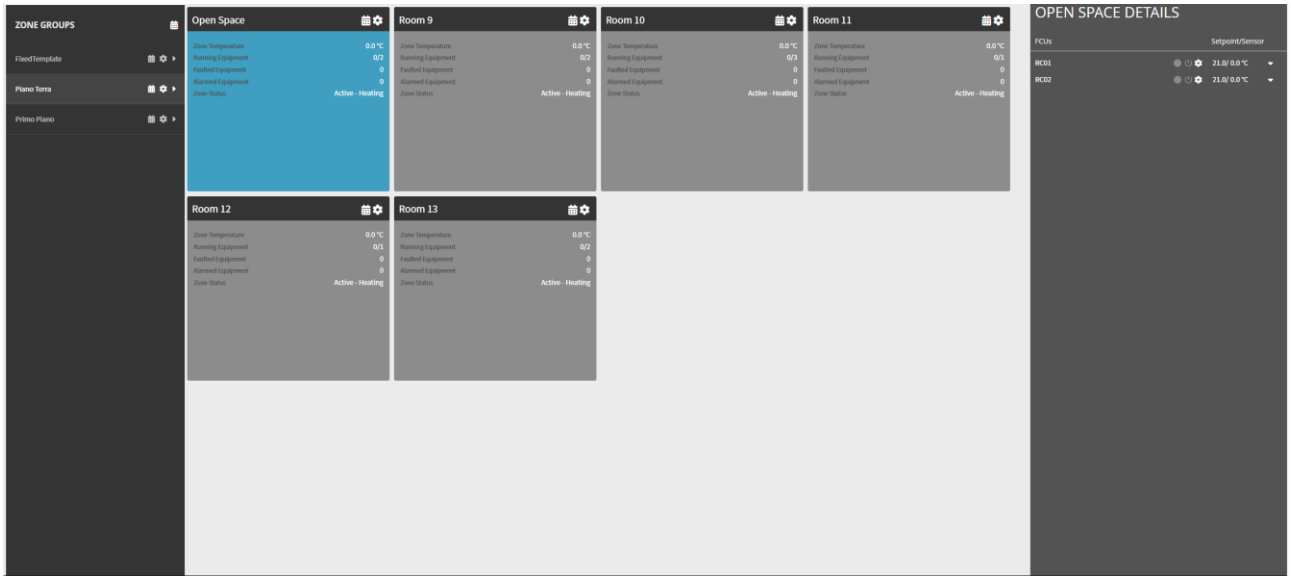
Setpoints	Description	Auto	Manual	Shutdown
Plant Setpoints				
Stage Up Cooling	Forces the plant to stage up cooling. Will warn user if conditions are not suitable for stage up cooling.	YES	NO	NO
Stage Down Cooling	Forces the plant to stage down cooling. Will warn user if conditions are not suitable for stage down cooling.	YES	NO	NO
Stage Up Heating	Forces the plant to stage up heating. Will warn user if conditions are not suitable for stage up heating.	YES	NO	NO
Stage Down Heating	Forces the plant to stage down heating. Will warn user if conditions are not suitable for stage down heating.	YES	NO	NO
Clear Timers	Clear the delay timers or inhibition timer to check the Staging conditions	YES	NO	NO
End Transitions	Forces sequence transitions to end.	YES	NO	NO
Primary Circuit Setpoints				

Setpoints	Description	Auto	Manual	Shutdown
Plant CHW/ HW Setpoint	Overrides the plant CHW setpoint	YES	YES	YES
Plant Field DP Setpoint	Overrides the plant Field DP setpoint	YES	YES	YES
Chiller Setpoints				
Chiller Set Offline	**Overrides the chiller service state to Offline.**	YES	YES	YES
Chiller CHW/HW Setpoint	Overrides the chiller CHW setpoint.	YES	YES	YES
Chiller Demand Limit	Overrides the chiller demand limit.	YES	YES	YES
Start Chiller	Starts the chiller. Note that this is done via SmartControlSystem control of the chiller and will therefore follow the normal start procedure, automatically turning pumps on and will adhere to all timers and safeties for operation.	NO	YES	NO
Stop Chiller	Stops the chiller. Note that this is done via SmartControlSystem control of the chiller and will therefore follow the normal stop procedure and adhere to all pump run on times.	NO	YES	NO
Pump Setpoints				
Start Pump	Starts a constant speed pump. This is a permanent override.	NO	YES	NO
Stop Pump	Stops a pump. This is a permanent override	NO	YES	NO
Reset Pump	Resets all overrides on the pump	NO	YES	NO
Set Pump Frequency	Starts a variable speed pump and sets its frequency. This is a permanent override.	NO	YES	NO
Pump Set Available	This button removes any override on the service state of the pump and makes the service state of the pump available. This reinstates the pump into the automatic pump control sequence and will allow the pump to be enabled during plant operation when required	YES	YES	YES
Pump Set Offline	This button overrides the service state of the pump to offline. It removes the pump from the automatic pump control sequence and will prevent the pump from being enabled during plant operation	YES	YES	YES

Table 26 - Possible overrides of setpoints and commands for Waterside equipment

6.10 Airside

Accessing to the main menu, PlantManager user can open the Zones menu.
The Zones Dashboard allows a user to both view and control the airside of SmartControlSystem . The page contains a detailed summary of the Airside layout of your installation, from Zone Groups down to the individual equipment. The control of the individual equipment is available to a Configuration or Plant Manager user, with all users having access to view all data from the airside equipment.
The page consists of 3 major regions, with the left region containing Zone Groups, the middle region contains Zones, with the right region containing the individual equipment of a selected zone, fo example AHUs and FCUs.



6.10.1 Schedule Control

The `Schedule` configuration ( ) will be present on 4 levels with the following hierarchy:

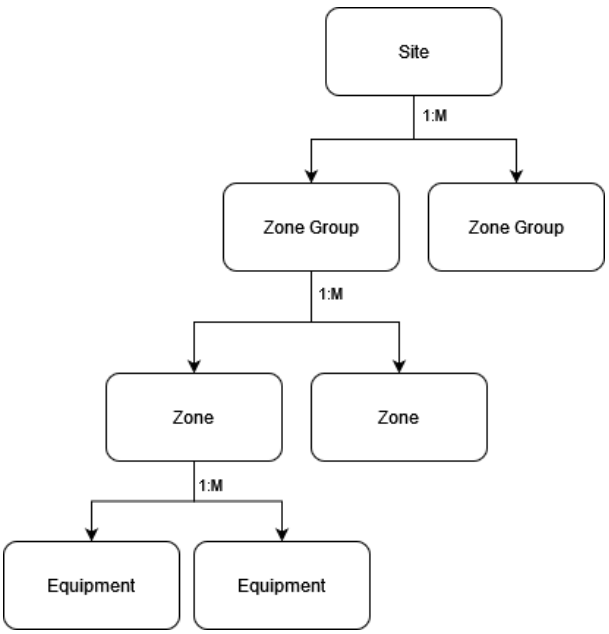
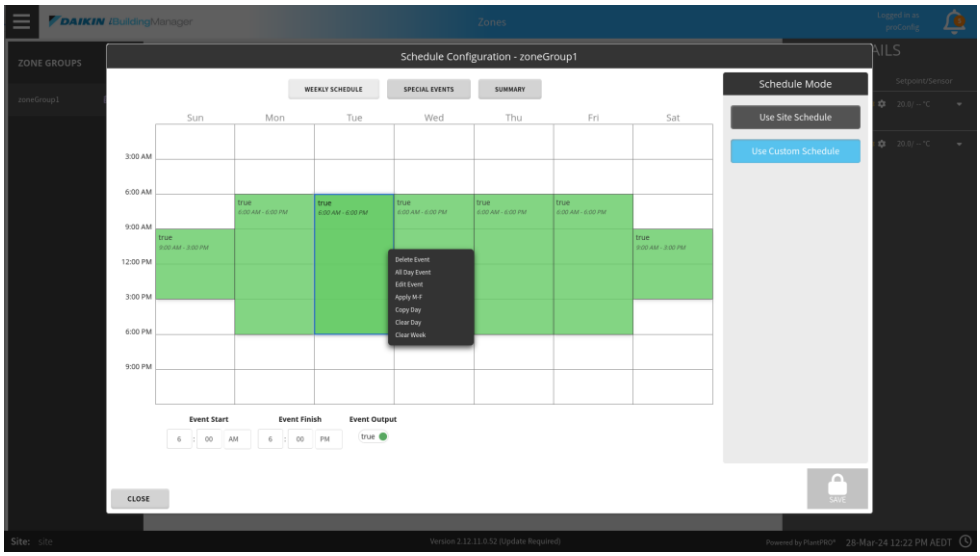


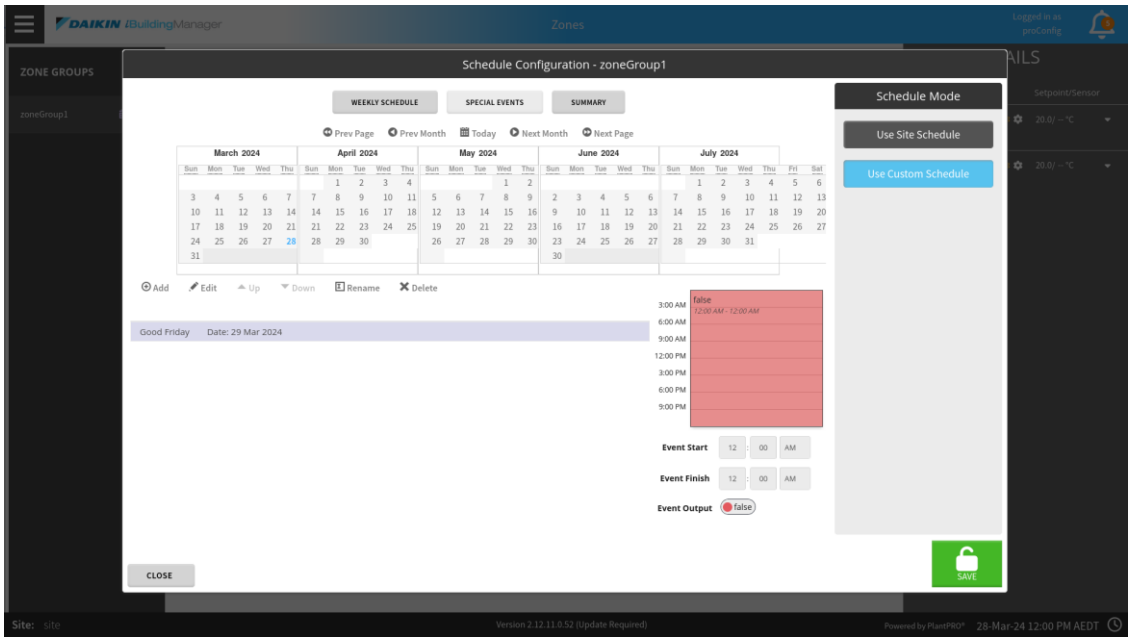
Figure 79 - Airside hierarchy

If a schedule is not enabled at a given level, the schedule of the parent level will be used, all the way up to the site, which must always have a configured schedule.

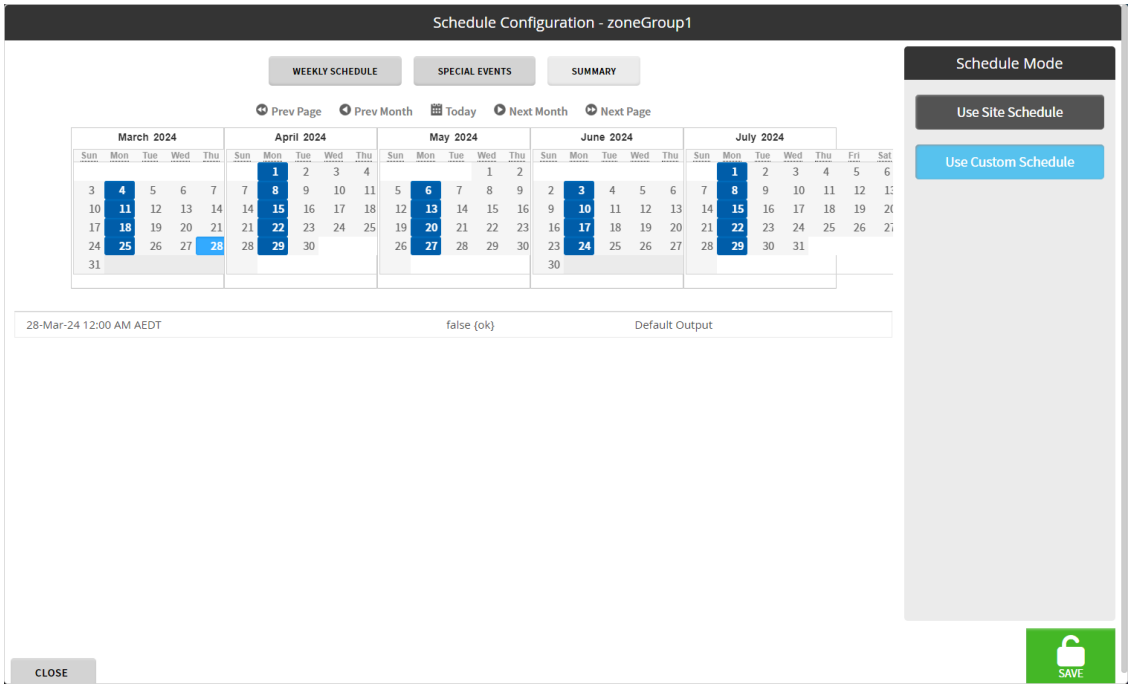
When clicking on the icon for any entity, a popup dialog will be displayed as shown below. This can be used to configure the enabled hours for that entity, and any children entities without schedules of their own.
On the right, one of two options can be chosen to schedule enabling control.
First, the `Use (parent) schedule` option, will use the parent entity schedule as its own schedule. Note that `Site` is the top level, therefore cannot use parent schedule.
Second, the `Use Custom Schedule` option, will allow user to configure times to enable during the week. Click and drag on each weekday to configure hours during which contained equipment should be enabled. Any duration without an active period will be a time during which the equipment is disabled. Right click on a period to delete it or access options to apply the same period on other days.



Special events can also be configured using the special events tab. Click add to add a new event, configure the appropriate day or days for this event to override the default weekly schedule and then use the day overview at right to configure the equipment state for the event.



Finally, the summary tab can be used to see the month-by-month overview of the schedule. Each day is coloured blue if equipment will be enabled by this schedule for any time during that day. The days can be clicked on to view the hour-by-hour changes to enable state.



6.10.2 Setpoint Control

The Setpoint configuration (⚙) will be present on 3 levels with the above hierarchy from the Zone Groups and down. When a setpoint is applied at a given level, it will be set on all equipment below it. For example, applying a setpoint to a zone group will affect all equipment in all zones in that zone group.

If the setpoints are not configured at Zone group and Zone level the Endpoint Equipment under that Zone Group and Zone will be set to the default heating and cooling setpoints which are respectively 21°C and 24°C.

When clicking on the  icon for any entity, a dialog as depicted below will be displayed. This can be used to configure the cooling and/or heating setpoints for that entity, and all contained entities without configured temperature setpoints of their own. By clicking on the Show Advanced Setpoint slide bar, you will also be able to configure the heating and/or cooling deadbands for that entity.

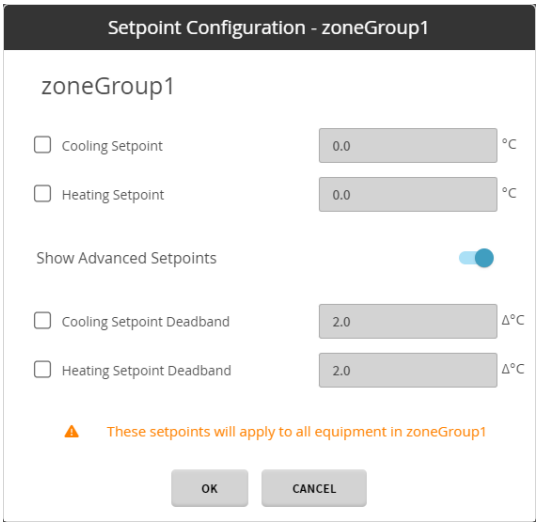


Figure 80 - Setpoint setting

6.10.3 Zone Groups

Zone groups represent a collection of individual regions (Zones) within a building, for example a Zone Group could represent an entire floor. By selecting a Zone Group from the left-hand menu, SmartControlSystem will display all Zones that belong to the selected Zone Group in the middle region of the page. As mentioned earlier, both the Schedule and Setpoints can be controlled by a Plant Manager or Configuration user by selecting the Calendar and Cog respectively.

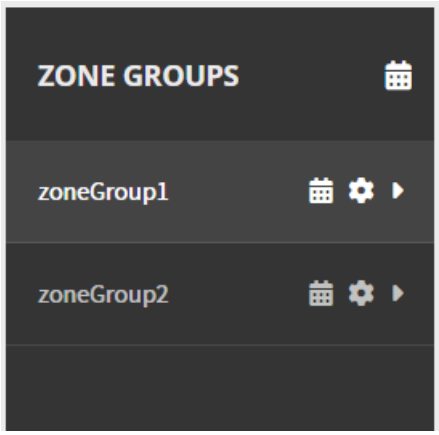


Figure 81 - Zone Group Widget

6.10.4 Zone

Zone groups represent region of a building containing a collection of Airside Equipment servicing that region, for example a Zone could represent an office or an entire cafeteria. Zones are shown in the centre region and are represented by Cards. The Zone Card contains a set of relevant data for each Zone. By selecting a Zone Card, SmartControlSystem will display all Equipment that belong to the selected Zone in the right-hand side of the screen, and the selected Zone will be highlighted. As mentioned earlier, both the Schedule and Setpoints can be controlled by a Plant Manager or Configuration user by selecting the Calendar and Cog respectively.

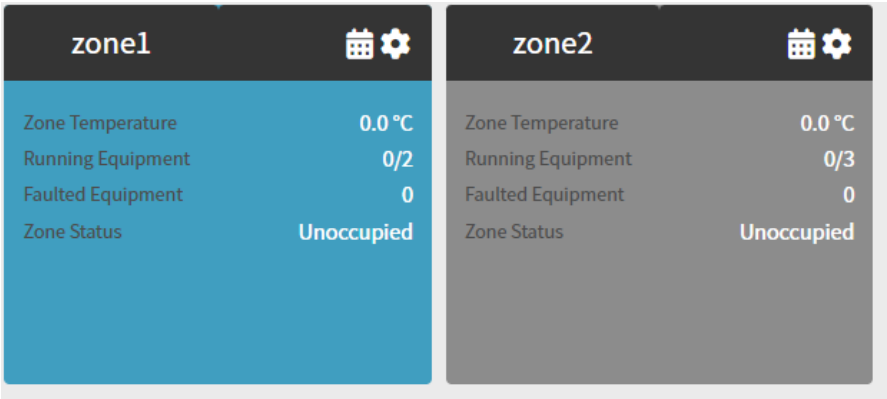


Figure 82 - Zone Widget

Summary of data shown

Data	Description	SI Unit	US Unit
Zone Temperature	The current temperature of the Zone.	°C	°F
Running Equipment	The number of running Equipment in the zone, followed by the total number of Equipment in the Zone.		
Faulted Equipment	The number of Equipment that are currently in a Faulted state.		
Zone Status	The current Status of the Zone. See the table below for details on each Status.		

Table 27 - Zone Widget Data

Zone Status	Description	Notes
Occupied - Heating/Cooling	Based off the schedule, whether the Zone is between it's Start and End time.	
Warm Up/Cool Down	A pre Cooling/Heating mode before the scheduled time.	Only available if Pre-Cooling/Pre-Heating is configured.
Afterhours Heating/Cooling	Cooling or Heating to a separate (less stringent) setpoint outside of its active time.	Only available if Afterhours Cooling/Heating is configured.
Unoccupied	Based off the schedule, whether the Zone is outside it's Start and End time.	
Freeze Protection	Heating is enabled to avoid temperatures getting to freezing levels.	Only available if Freeze Protection is configured.

Table 28 - Zone Statuses

6.10.5 Equipment

The Equipment region displays all the End Point Equipment that are associated with the selected Zone. These are the Equipment that are supplying air to Zone using the supply water from your Plant. The Equipment are displayed in a list, with each equipment being categorized by their type (FCU, AHU, Room Controller, etc).
Each item in the list will contain a summary of data from their Equipment.

Figure 83 - Equipment icon

Data	Description	SI Unit	US Unit
Name	The name of the equipment		
Run Status Icon	Green when the equipment is running, gray otherwise.		
Control Mode Icon	Displays an Ice icon for cooling, and a Sun icon for heating, a Stop if stopped.		
Setpoint Control Icon	A gear icon that will open a popup for setting the current setpoint of the Equipment. Only accessible to Config and Plant Manager.		
Setpoint	The current controlling setpoint of the Equipment.	°C	°F
Temperature	The current room temperature read from the Equipment.	°C	°F
Expand Icon	Expands the row, displaying detailed running information of the equipment.		

Table 29 - Equipment icons

Each item in the list can be expanded, which will display a set of controls for the Equipment if logged in as a Plant Manager or a Configuration user. These controls allow the user to temporarily take control of the Equipment, with some of the controls displaying a popup as they require input from the user. Additionally, the expanded item will also display detailed information about the equipment. Each equipment displays relevant to their equipment type, which are explained below.

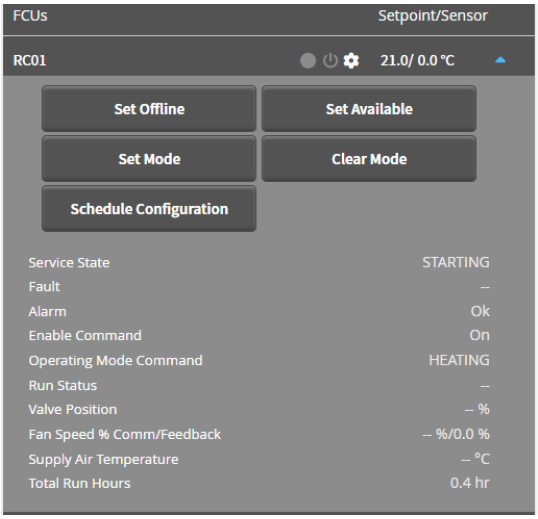


Figure 84 - Equipment Data

Data	Description	SI Unit	US Unit
Service State	The Service State reflects its availability and provides an indication of whether the unit is available and can be included in the control sequence.		
Fault	Whether the Equipment is in a Fault state and stops by itself		
Alarm	Whether the Equipment suffers an alarm that does not stop the functioning but working unproperly		
Enable Command	The Enable Command being sent to the Equipment		
Operating Mode Command	Operating Mode Command (Cooling or Heating) being sent to the Equipment		
Run Status	The Run Status received from the Equipment.		
Cooling Valve Position	The opening percentage of the cooling valve.	%	%
Heating Valve Position	The opening percentage of the heating valve.	%	%
Fan Speed Percentage Feedback	The current fan speed. It could be in percentage or in steps	%	%
Supply Air Temperature	The current temperature of air being supplied by the equipment (if available).	°C	°F
Total Run Hours	The total run hours of the AHU.	hr	hr

Table 30 - Equipment Data

Data	Description
Only Accessible to Configuration and Plant Manager	
Set Offline	Temporarily overrides the Equipment offline for the length of duration selected in the dialog.
Set Available	Clears the override applied by Set Offline.
Schedule Configuration	Configures the Schedule for this Equipment.
Only Accessible to Configuration	
Set Mode	Temporarily overrides the operating mode of the Equipment for the length of duration selected in the dialog.
Clear Mode	Clears the override applied by Set Mode.

Table 31 - Equipment Controls

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